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Essays on Corporate Risk Management

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Essays on Corporate Risk Management

By

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To my parents and husband for their years of encouragement and support and
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Essays on Corporate Risk Management

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This dissertation addresses issues in corporate risk management. Part I examines the determinants for corporate decisions to commodity hedge and to the extent of hedging. Chapter 1 discusses prior literature, including theory and empirical evidence on corporate risk management. It provides the background to support the empirical analyses of Chapters 2, 3 and 4. Chapter 2 examines corporate decisions to commodity hedge. I find that firms are more likely to hedge when they are big, have risk management department set up and have more of their competitors hedge. Chapter 3 investigates what determines the extent of hedging conditional on hedging decisions and the cross-sectional and

time series deviation of the hedge ratio. I find that firms tend to hedge less when they have younger CEOs and have more options in their compensation plan.

I also find that when determining the hedge ratio, firms with young CEOs and higher option compensation tend to respond to past commodity price growth and to deviate from industry average. Part II investigates the relationship between corporate risk management and product market competition. Chapter 4 examines the different product market performance for firms with different hedging polices after commodity price shocks. I find that unhedged firms which are ex ante financially constrained lose market share and experience a decreased profitability during and after commodity price shocks. Chapter 5 examines whether the loss of unhedged constrained firms in product market is driven by the competitors. I find that firms with financial advantages—unconstrained hedged firms—tend to increase advertising expenditures and decrease price-cost-margins during negative commodity shocks, indicating that the market share loss of constrained unhedged firms is due to increased competition in the product market. Chapter 6 examines whether corporate risk management affects the likelihood of firms exiting the market. I find that constrained unhedged firms are 6% more likely to exit the market than their unconstrained hedged rivals and the effects are stronger in concentrated industries and industries with higher leverage dispersion.

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Chapter 1
Introduction to Corporate Risk Management

1.1 Introduction

The corporate risk management literature has increased in popularity for the past two decades as derivative markets develop. Many studies focus on the rationales for firms' hedging and suggest several reasons that firms should hedge: hedging relieves under-/over-investment costs[1], decreases financial distress costs[2], reduces taxes[3] and decreases agency costs[4]. Despite all the rationales the literature suggests, less than 50% of firms hedge in any type of hedging, less than 30% of firms hedge commodity exposures and the average hedge ratio[5] among the firms that do hedge is less than 30%.

Although many studies have dedicated to risk management determinants, it is still unclear what drives firms to hedge and how much to hedge. Part of the reason of the lack of a consensus is the lack of broad data on hedging, especially across-industry commodity hedging. To address these questions, I examine the hedging policies of 579 firms in 10 industry groups over the period of 1994-2008. Specifically, Chapter 2 investigates the factors that associate with firms' decisions to hedge and the dynamic change from non-hedgers to hedgers for the first time. Chapter 3 investigates the extent of hedging conditional on

[1] See Smith and Stulz (1985), Froot, Scharfstein and Stein (1993), Lin and Smith (2003), and many others
[2] See Haushalter (2000), Rogers (2002) and Dionne and Garand (2003), etc
[3] See Smith and Stulz (1985), Tufano (1996), Graham and Smith (1999), Graham and Rogers (2002), etc
4 See Tufano (1996), Stulz (1990), Triki (2004, 2005), etc
[5] Hedge ratio is defined as notional dollar amount hedged divided by last year's exposure.

hedging. Chapter 4 studies what drives firms to hedge differently from their competitors and closely examines the hedging policies for different industries.

This chapter proceeds as follows. Section 1.2 discusses the literature related to the theories of corporate risk management. It establishes the framework to test the determinants of hedging. Section 1.3 reviews the empirical studies on corporate hedging. It shows the merits and limitations of past literature and how my dissertation may contribute to the literature. Finally, Section 1.4 concludes the chapter.

1.2 Theories on Corporate Risk Management

Hedging that smoothes cash flow should not affect firm value in the Modigliani and Miller (1958) framework. Several theoretical studies argue that corporate risk management activities are value-enhancing by introducing frictions to the perfect Modigliani and Miller world.

The tax argument is first introduced by Smith and Stulz (1985). They augue that if the firm faces a convex tax function, because hedging reduces the volatility of the firm's cash flow, by Jensen's inequality the firm will have a lower tax liability. Therefore, for a firm with convex tax function, as long as hedging costs are greater than its benefits, hedging enhances after tax firm value. This prediction is confirmed by Nance, Smith and Smithson (1993) and many other following studies.

Smith and Stulz (1985) also suggest that financial distress costs provide a valid explanation to corporate risk management because firms with hedging activities face lower probability of financial distress. They argue that hedging can decrease the present value of

financial distress costs for a fixed investment policy. Consequently, hedging increases firm value because it decreases the expected value of direct bankruptcy costs and the loss of debt tax shield. The prediction is confirmed by Berkman and Bradbury (1996) and Haushalter (2000) and other studies.

Underinvestment problem is another popular explanation of corporate risk management. It describes cases where shareholders forego positive net present value projects because the gains mainly go to bondholders [see Myers (1977)]. Hedging can decrease the underinvestment costs by shifting cash from states in which income are sufficient to meet the firm's obligations to states where cash flows are insufficient to do so. Furthermore, Froot, Scharfstein and Stein (1993) show that, when the cost of external financing is higher than the cost of internal financing, hedging can alleviate the underinvestment problem because it ensures the availability of internally generated funds to meet the need of the firm's investment opportunities. Morellec and Smith (2002) and Lin and Smith (2003) consider simultaneously the financing, investment and risk management decisions and also prove a positive relationship between hedging and the firm's investment opportunities.

Agency cost is another rationale for firms' hedging activities. Managers are usually less diversified than regular investors because they have the present value of future compensations tied to the firm's value. Consequently, they will require additional compensation if they feel exposed to a high level of risk through the firm. Hence, managerial risk aversion provides an incentive for corporate hedging because risk management could

lower equilibrium managerial compensation. Smith and Stulz (1985) show that compensation packages that lead to a concave function between the managers' expected utility and the firm's value should encourage managers to hedge more. Accordingly, managers holding a significant fraction of the firm's shares should engage more actively in risk management. Smith and Stulz (1985) also suggest that managers with important options holdings hedge less because options provide a convex relationship between the managers' utility and the firm's value. Tufano (1996) and Rogers (2002), among others, find support for this argument. However, Carpenter (2000) argues that stock options have two opposing effects on corporate hedging. First, as the volatility of the firm stock returns increases, the payoffs from options become more important. This effect leads managers to hedge less. Second, as the stock price decreases, the payoffs from options become less important. This effect drives managers to increase their hedging to avoid further drop in the share price. The hypotheses are confirmed by evidences shown in Knopf, Nam and Thornton (2002) and Géczy, Minton and Schrand (1997).

1.3 Empirical Evidence on Corporate Risk Management

After the literature established theories of corporate risk management determinants, many empirical works developed to test the predications of the theories. Nance, Smith and Smithson (1993) is one popular study among early works. They use survey data on firms' use of forwards, futures, swaps, and options of 169 firms in 1986. They find that firms which hedge have more convex tax functions, have less coverage of fixed claims, are larger, have more growth options in their investment opportunity set, and employ fewer hedging

substitutes. Although their work is broad, survey data is subject to response bias that firms which hedge are more likely to respond to the survey[6]. Another drawback of the paper is that they do not test the extent of hedging because of the data availability.

Tufano (1996) examines a detailed corporate risk management dataset in the North American gold mining industry. He finds little empirical support for the theories that view risk management as a means to maximize shareholder value. However, he finds that firms whose managers have more options hedge less gold price risk, and firms whose managers hold more stock hedge more gold price risk. He also finds that risk management is negatively associated with the tenure of firms' CFOs. His empirical results suggest that managerial risk aversion and preferences may affect corporate risk management policy. Although for gold mining industry only, Tufano (1996) examines risk management in detail and sets a good example for further studies. Many other papers[7] use this detailed dataset for the gold mining industry, which is ended in 1999.

Mian (1996) uses a sample of 3,022 firms with hedging data from the 1992 annual reports. She finds evidence inconsistent with financial distress cost models; evidence mixed with respect to contracting costs, capital market imperfections, and tax-based models; and evidence supports the hypothesis that hedging activities exhibit economies of scale. The paper has a very large sample compared to previous studies. Nevertheless, the paper uses a

[6] In their sample, they sent out 535 surveys to all Fortune 500 and the S&P 400 firms. 169 firms completed the survey among which 104 firms used hedging instruments in 1986.
[7] See Dionne and Garand (2003), Brown, Crabb and Haushalter (2003) among others.

dummy variable to capture whether firms have outstanding hedging instruments and does not examine the extent of hedging.

Géczy, Minton and Schrand (1997) use a sample of 372 Fortune 500 nonfinancial firms in 1990 to examine the use of currency derivatives. They find that firms with greater growth opportunities and tighter financial constraints are more likely to use currency derivatives. They also find that firms with more foreign exchange-rate exposure and economies of scale in hedging activities are more likely to use currency derivatives.

Haushalter (2000) studies the hedging policies of oil and gas producers between 1992 and 1994. He finds that the extent of hedging is related to financing costs. Firms with greater financial leverage manage price risks more extensively. He also finds that the likelihood of hedging is related to economies of scale in hedging costs and to the basis risk of hedging instruments. Larger companies are more likely to manage risks and companies which are located in regions where prices have a high correlation with the prices of exchange traded derivatives are more likely to hedge.

Purnanandam (2008) uses a comprehensive data set for 1996 and 1997. He finds a non-monotonic relation between leverage and hedging. He also finds that the effect of leverage on hedging is more significant for firms in highly concentrated industries.

My dissertation supports several explanations for corporate risk management. First, firms in weak financial situation are less likely to hedge, which is consistent with fixed cost of setting up hedging program and inaccessibility in the derivative market. Consistent with

the notion, Haushalter (2000) and Géczy, Minton, and Schrand (1997) find a positive correlation between the decision to hedge and total assets.

Second, the correlation between firms' hedging activities and managerial risk aversion is consistent with the stream of literature showing that firms' hedging decisions are related to managerial stock and option compensation. For example, Tufano (1996), Rajgopal and Shelvin (2002) and Rogers (2002) find that managers with higher options holdings hedge less because options compensation create a convex relation between the managers' utility and the firm's value. But on the other hand, Carpenter (2000), Knopf, Nam and Thornton (2002) and Géczy, Minton, and Schrand (1997) find the opposite relationship between stock options compensation and hedge ratio. Carpenter (2000) argues that managers hedge more with more options holdings in order to avoid large drop in stock price, which makes their options holdings less valuable. The results in my dissertation support the first set of literature and show that CEOs with higher risk appetite—younger CEOs and CEOs with higher options compensation tend to hedge less.

My dissertation is closely related to Haushalter (2000) that separately examines the determinants of decision to hedge and the extent of hedging. Similar to Haushalter (2000), I also find that the determinants of whether to hedge and how much to hedge are very different. My study has three important distinctions from his work and the rest of the literature. First, I have a relative long sample period of 1994 to 2008. It allows me to directly test what drives the firms' dynamic changes from non-hedgers in the past to hedgers. I find that firms are more likely to hedge for the first time when they increase their leverage, their

debt ratings and profitability improve and when the concentration in industry increases. The results suggest that firms start to hedge when the benefit of hedging increases and when their ability to hedge increases. The long sample period also allows me to test whether the extent of hedging changes according to past commodity price growth. I find that firms increase the amount they hedge when past commodity price increases and firms with young CEO and more option compensation tend to respond to past commodity price growth.

The second distinction is that, unlike other studies, this study has multiple industry samples, which allows me to analyze the between-industry difference on why firms do not hedge. The paper tests the determinants of firms whose hedge ratios deviate from industry average. I find that firms with young CEOs and higher option compensation ratio in low Herfindahl industry tend to hedge less even when their competitors hedge more. The results suggest that those CEOs tend to be over-confident with less risk aversion. It also suggests that firms are more likely to hedge less in a highly competitive industry with a low Herfindahl index because they are subject to less predation risk in those industries.

Third, most the studies use Tobit model[8] to examine the determinants of the decisions to hedge, while others use Cragg model[9]. Although the Tobit model has received extensive use in hedge ratio analysis, it has the restriction that the same factors are assumed to affect the probability of hedging and the magnitude of the hedge in the same way given that a hedge is conducted. In the Cragg model, it is assumed that the probability of hedging and hedge ratio regressions are assumed to be independent. This assumption is somewhat

[88] For example, Tufano (1996) and Rogers (2002)
[9] See Haushalter (2000)

unrealistic. To address the above issues, I use a Heckman selection model, which allows the variables affecting each decision to differ, but does not require that the two equations be independent.

1.4 Conclusions

This chapter presents a brief overview of the theories and empirical evidence related to corporate risk management. It is clear that there are different rationales for firms to conduct hedging activities. It is also true that there exists evidence consistent with different hedging theories for certain industries and certain sample period. However, there is still no general evidence for the determinants of the extent of hedging for other industries than gold mining and oil and gas industries. Furthermore, it remains unclear how firms change their hedging activities dynamically over time. Chapter 3 and 4 in this dissertation address these questions.

Another obvious question is, if managers believe hedging is beneficial, why do not all firms hedge and why some firms hedge less than their competitors. Chapter 2 and 4 in this dissertation looks directly into these questions.

Chapter 2
Decisions of Corporate Risk Management

2.1 Introduction

In this chapter, I investigate the factors that associate with firms' decisions to hedge and the dynamic change from non-hedgers to hedgers for the first time. I examine the hedging policies of 579 firms in 10 industry groups over the period of 1994-2008. Specifically, I find that firms are more likely to hedge when they are bigger, hedge other type of exposures[10] and when a larger portion of their competitors hedges. On the other hand, firms that do not hedge are the smaller firms, with less debt, but higher KZ measures and lower profitability. In general lower leverage ratio could indicate more financial flexibility. However, together with a higher KZ index, lower debt rating and lower profitability, less debt is more likely to be a signal that the firms are financially constrained and cannot acquire enough debt. The results suggest that those firms do not hedge because they do not have enough financial resources to develop a risk management department or to find counterparties for the derivative contracts. I also find that firms are more likely to hedge for the first time if their KZ index decreases, debt rating increases or profitability increases. It suggests that firms

[10] "Hedge other type" is a binary variable that equals to 1 if the firm hedge interest rate or exchange rate. It is a proxy for setting up the risk management department.

start to hedge when their financial situations improve and allow them to set up a hedging program.

The results are consistent with Haushalter (2000) and Géczy, Minton, and Schrand (1997) who find a positive correlation between the decision to hedge and total assets. Firms in weak financial situation are less likely to hedge, which is consistent with fixed cost of setting up hedging program and inaccessibility in the derivative market.

The rest of the chapter is organized as follows. Section 2.2 describes the data used in this chapter. Section 2.3 discusses the methodology used to analyze the determinants of hedging and presents the results. Section 2.4 concludes the chapter.

2.2 Data

The sample consists of manufacturing and airline industries which have hedgeable commodities as significant inputs components. I identify industries with commodity inputs using the U.S. Bureau of Economic Analysis (BEA) benchmark input-output tables in 2002. I rank the percentage of commodity usage in each industry's total inputs, where commodities are defined as 30 hedgable commodities traded on the Chicago Merchandise Exchange, the Chicago Board of Trade and the New York Merchandise Exchange. The list of two-digit-SIC industries is reported in Table 2.1.

The sample covers the period of 1994-2008 because SEC electronic data becomes available in 1994. The sample consists of 976 firms and 31 three-digit-SIC industries. I exclude: (1) firms without 10-K or 10-Q forms in SEC EDGAR, (2) firms with less than

three years of data after the commodity shock[11], (3) firms with negative sales or asset data during the sample period, (4) industries with only one firm. After applying the above rules, I obtain the final sample of 579 firms, 6276 firm-year observations. I compare the characteristics of the final sample used in this paper, of all manufacturing firms and of all Compustat firms. The summary statistics of different samples are reported in Appendix B. The final sample used in the paper consists of more mature and larger firms, firms with lower R&D expenses, higher financial constraints and higher industry concentration.

Hedging data are hand collected with keyword searching in 10-K forms from SEC EDGAR. The keywords used include: "hedg", "derivative", "market risk" and "raw material". Then the paragraph around the keywords is read to identify whether it is a hedge, what kind of hedge it is[12], what kind of derivatives they use, the notional value and the fair value of the hedge if available. A natural hedge is identified when a firm states in the filings that it uses long-term contracts with either supplier or consumers to fix the price for at least one year[13]. Pass-throughs are not considered to be natural hedges unless there is a written contract of passing most of the input price increase to the customers. I exclude pass-through as an effective hedge because large increases in the input price are hard to pass-through to customers if there is competition in the industry. *Hedge*[14] dummy equals to 1 if the firm hedges any type of exposure or if the firm uses natural hedges during the fiscal year. The

[11] I discuss the potential survival bias by restricting firms with five years data in section IV. Generally, including only firms who survive for three years after a shock underestimates the results of predation because the exiting firms are more likely to be the target of predation and those firms tend to be financially constrained and unhedged.
[12] I classify hedges into interest rate hedge, exchange rate hedge and commodity hedge.
[13] Firms can also match input and output currency as a natural hedge for exchange rate risk.
[14] In some tests, Hedge dummy may be restricted to commodity hedge.

hedge ratio is the total notional amount of derivatives divided by cost of goods sold (COGS) except for the Airline industry where all firms report notional amount of derivatives as a percentage of anticipated usage of a commodity. Refer to appendix A for details on the hedge ratio and the notional value of hedges. Refer to Appendix A for more details on hedging data.

Other data sources are as following. Firm characteristics are from Compustat. Stock return data are from CRSP. Cotton prices are from the National Cotton Council of America. Lumber prices are from Random Length, a wood industry website. Crude oil, natural gas and jet fuel prices are from the Energy Information Administration. Metal price data are from Commodity Research Bureau, which collects data from the American Metal Market.

2.3 Methodology and Results

2.3.1 Methodology

In order to separately examine corporate decisions to hedge and extent of hedging, two-stage Heckman model is used. The first stage of Heckman consists of the following Probit regressions of corporate hedging.

$$Prob\left(H_{i,t} = 1 \middle| X_{i,t-1}, Z_{i,t-1}\right) = \Phi(X_{i,t-1}\delta, Z_{i,t-1}Y) \tag{2.1}$$

where X_{t-1} is a vector of control variables, including leverage, KZ, debt rating, investment, ROA, dividends ratio, cash holdings, Herfindahl index, log of tax loss carry forward, young CEO dummy, stock compensation ratio and option compensation ratio.

$Z_{i,t-1}$ is a vector of exogenous variables that affect whether firms hedge but less likely to affect hedge ratio in the second stage.

$$Z_{i,t-1} = \{Size_{i,t-1}, Age_{i,t-1}, OtherHe_{i,t-1}, PerHe_{i,t-1}\} \quad (2.2)$$

$Size_{i,t-1}$ is the total assets for firm *i* at time *t*; $Age_{i,t-1}$ is firm age at time *t-1;* Firm size and age proxy for firm visibility, which affects whether firms hedge, but not the extent of hedging[15]. $OtherHe_{i,t-1}$ is the dummy variable that equals to one if firm *i* hedge other type of risk, interest rate risk or foreign exchange rate risk in the past up to *t-1*. It is a proxy for that the corporate risk management program has already been set up. $PerHe_{i,t-1}$ is the percentage of firms hedge in the three-digit SIC industry, except for firm *i* itself. Evidence[16] shows that firms are more likely to hedge when more of their competitors are doing so.

Other variables used in this chapter are defined as follows. *Size* is the market value at the end of each year. *Age* is the years since it first appears in CRSP. *R&D expense* is scaled by sales and shown in percentage. *Investment* is the capital expenditure divided by total assets. *Leverage* is the book value of the total debt divided by the total asset. *Long term debt* is the long term debt scaled by the total asset. *Cash holdings* are the cash and cash equivalent investment divided by the total asset. *Current ratio* is current asset divided by current liability. *KZ index* is defined using Lamont, Polk, and Saá-Requejo, (2001) formula. *Operating profit margin* is the gross income divided by total sales. *ROA* is the operating income divided by the total asset.

[15] Haushalter (2000) and Géczy, Minton, and Schrand (1997) find a positive correlation between the decision to hedge and total assets. Haushalter (2000) also find that firm size is less important in determining hedge ratio.
[16] Nian (2004) and Adam and Nian (2008)

Q is the market value of equity plus book value of debt divided by the total assets. *Herfindahl* is the sum of squared market share of the top 50 firms in 3-digit-SIC industry. *Number of firms* is the number of firms in 3-digit-SIC industry. *Debt Rating* is the index of S&P debt rating, with 0 means no rating, 1 means under C, 21 means AAA, etc. *LTLCF* is the log of 1+Tax Loss Carry Forward. *Young_CEO* is the dummy variable that equals to one if the age of CEO is under 45. *Stock Compensation ratio* is value of stock compensation divided by total compensation. *Option Compensation ratio* is the value of options compensation divided by total compensation.

The summary statistics of the characteristics of each of the three hedging frequency groups are reported in Table 2.2. Firms that do not hedge tend to be younger, smaller, with less R&D expenses and lower investment. They also have lower measures of profitability and lower leverage ratio. Firms that hedge less than industry median tend to be older, with less R&D expenses and lower investment. They also have young CEOs and have higher stock and options compensation ratio. Firms that hedge more than industry median are bigger firms, have better performance and higher firm value.

In additional to the decision to hedge, I also analyze firms' dynamic changes from non-hedgers to hedgers for the first time since the firms start to appear in SEC EDGAR database. Analyzing this dynamic change would shed some light on what determines the change and why firms do not hedge in general.

The following Probit regressions are conducted.

$$Prob\left(H_{i,t} = 1 \middle| \Delta X_{i,t-1}\right) = \Phi\left(\Delta X_{i,t-1}\delta\right) \quad (2.3)$$

where $H_{i,t}$ is a binary variable that equals to 1 if firms hedge for the first time. X_{t-1} is a vector of control variables, including the changes of firm size, leverage, KZ, debt rating, investment, ROA, dividends ratio, cash holdings, Herfindahl index, log of tax loss carry forward, stock compensation ratio and option compensation ratio and the level of young CEO and firm age.

2.3.2 Results

The results on corporate decisions to hedge are reported in Table 2.5. Firm size, debt ratio, debt rating, and stock compensation ratio are positively correlated with corporate decisions to hedge, while KZ index, rating less than BBB dummy and Herfindahl are negatively correlated with probability of hedging. The results are consistent with the majority of the literature that bigger firms with higher leverage are more likely to hedge.

In addition to the results which are consistent with previous literature, I also find that *Other Hedge* dummy, which is 1 when firms ever hedge other type of exposure in the past, are positively related to firms' likelihood of hedge. It suggests that firms with established risk management program are more likely to hedge commodity exposure too. Furthermore, I find the percentage of hedgers in an industry positively affects firms' decisions to hedge, which indicates a spillover effect on corporate decisions to hedge.

Among all the determinants, firm size, the percentage of hedgers in industry and debt rating are the top three important characteristics. About 24-35% of variation in probability

of hedging is explained in the model. It is consistent with the view that the firms do not hedge when they are in the very weak financial situation that they do not have enough financial recourses to set up the hedging program.

All independent variables are measured at t-1. Model (3)-(4) include industry and year effects and Model (5)-(6) include industry by year effects. All models report T-stats calculated using heteroskedasticity adjusted standard errors and clustered at the firm level. All the independent variables in Heckman second stage (Equation 3.1, Table 3.1) are included together with the four instrument variables in $Z_{i,t-1}$. Some of the variables have no explanatory power and are not reported.

Table 2.6 reports the results for the dynamic changes of firms from non-hedgers to hedgers for the first time. Results show that when their debt ratio, debt rating, return of assets and stock compensation ratio increases at time *t-1*, and when the KZ index and option compensation ratio decreases at time *t-1*, the firms are more likely to start to hedge for the first time at time *t*. Among all the determinants, debt rating and return of assets increase are the most important factors associated with the change from non-hedgers to hedgers. It suggests that firms would start to hedge if their credit rating and profitability are better than before. The results indicate that the weak financial situation might be the main reason why firms cannot hedge.

2.4 Conclusions

In this chapter, I investigate the factors that associate with firms' decisions to hedge and the dynamic change from non-hedgers to hedgers for the first time. I find that firms are more likely to hedge when they are bigger, have risk management department set up and have more of their competitors hedge. On the other hand, firms that do not hedge are the smaller firms, with less debt, but higher KZ measures and lower profitability. The results suggest that those firms do not hedge because they do not have enough financial resources to develop a risk management department or to find counterparties for the derivative contracts. I also find that firms are more likely to hedge for the first time if their KZ index decreases and debt rating increases. It suggests that firms start to hedge when their financial situations improve and allow them to set up a hedging program.

Chapter 3
Extent of Corporate Risk Management

3.1 Introduction

Another important risk management policy, in addition to whether to hedge, is to decide how much to hedge. In this chapter, I investigate the factors that associate with the extent of corporate risk management.

Among all the studies that focus on the determinants of corporate risk management, less than 50% of the studies use a continuous measure of hedging[17]. Other than data availability, another important reason for the lack of continuous measure is that the gross notional value of hedging derivatives might overestimate the risk management activities when the firms hold offsetting contracts. Allayannis and Ofek (2001) point out an additional problem in the gross notional value for foreign exchange rate hedging. They emphasize that firms do not report derivatives holdings by individual currency and seem first to net positions on these currencies before aggregating them.

The data sample in my dissertation has advantages to overcome these concerns on using gross notional value as a measure of the extent of hedging. First, this chapter focuses on commodity hedging, which does not suffer the reporting problems mentioned in

[17] See the review in Triki (2005)

Allayannis and Ofek (2001). Second, my sample consists of commodity-input industries whose hedging activities are mainly on their input commodity exposures. These firms are less likely to hold offsetting contracts for their commodity hedging. Therefore, the measures on the extent of hedging I use in my dissertation are less subject to overestimation bias. Third, because my sample consists of commodity-input industries, I can scale the gross notional value of the derivatives contracts by the cost of goods sold (COGS) to measure the percentage of commodity exposures being hedged directly. By contrast, the literature usually scales the gross notional value of the derivatives contracts by total assets, which does not directly capture the exposures of commodity price risk.

I examine the hedging policies of 579 firms in 10 industry groups over the policies of 579 firms in 10 industry groups over the period of 1994-2008. Specifically, I find that firms with younger CEOs and have more options in their compensation plans hedge less of their exposures. The results suggest that managerial risk preference play an important role in setting up the extent of hedging. The results are consistent with Tufano (1996), which analyzes the hedging activities in the gold mining industry in 1986.

Furthermore, I find that the hedge ratio[18] is positively correlated with past commodity price growth rate. The firms with young CEO and higher option compensation are more likely to form their hedge ratios according to the past commodity price growth. It suggests that firms may deviate inversely from the optimal hedge ratio[19] according to past commodity price growth and managers with higher risk appetite are more likely to deviate. I also find

[18] Hedge ratio is defined as gross notional value of derivatives contracts divided by cost of goods sold.
[19] Assume there is only one optimal hedge ratio for the firms with certain characteristics.

that firms' hedge ratio is higher when the average hedge ratio in industry[20] is higher. It suggests that there is a spillover effect on the extent of hedging. The results are also consistent with the notion that competition in the product market affects corporate risk management[21]. Part II of my dissertation investigates this question in more detail. Interestingly, I find that the firms with higher debt ratio, young CEO[22] and higher option compensation are more likely to be independent from industry average hedge ratio. It suggests that firms may deviate from the optimal hedge ratio in the cross-section from their industry average and managers with higher risk appetite are more likely to deviate.

The rest of the chapter is organized as follows. Section 3.2 describes the data an variables used in this chapter. Section 3.3 discusses the methodology used to analyze the determinants of the extent of hedging. Section 3.4 presents the results and Section 3.5 concludes the chapter.

3.2 Data

The sample consists of manufacturing and airline industries which have hedgeable commodities as significant inputs components. I identify industries with commodity inputs using U.S. Bureau of Economic Analysis (BEA) benchmark input-output tables in 2002. I rank the percentage of commodity usage in each industry's total inputs, where commodities are defined as 30 hedgable commodities traded on the Chicago Merchandise Exchange, the

[20] The average hedge ratio in industry is calculated without the firm *i* itself.
[21] See Adam, Dasgupta and Titman (2007), Mello and Ruckes (2005) and Haushalter, Klasa and Maxwell (2007) for details.
[22] Morin and Suarez (1983), Pålsson (1996) find that the investor's risk aversion increases with age. Rajgopal, and Shevlin (2002), among others, find empirical evidence on the positive correlation between stock option compensation and risk taking.

Chicago Board of Trade and the New York Merchandise Exchange. The list of two-digit-SIC industries is reported in Table 2.1.

The sample covers the period of 1994-2008 because SEC electronic data becomes available in 1994. The final sample consists of 579 firms, 31 three-digit-SIC industries and 6276 firm-year observations. The details of this sample are discussed in Chapter 2.

Hedging data are hand collected with keyword searching in 10-K forms from SEC EDGAR. *Hedge*[23] dummy equals to 1 if the firm hedges any type of exposure or if the firm uses natural hedges during the fiscal year. The *hedge ratio* is the total notional amount of derivatives divided by cost of goods sold (COGS) except for the Airline industry where all firms report notional amount of derivatives as a percentage of anticipated usage of a commodity. Refer to appendix A for details on the hedge ratio and the notional value of hedges.

3.3 Methodology

In order to separately examine corporate decisions to hedge and extent of hedging, two-stage Heckman model is used. The second stage of Heckman consists of the following regressions of hedge ratio.

$$E[HR_{i,t}|X_{i,t-1}, H_{i,t} = 1] = X_{i,t-1}\beta + E[u|X_{i,t-1}, H_{i,t} = 1] \quad (3.1)$$

Under the assumption of error terms are jointly normal, we have

[23] In some tests, Hedge dummy may be restricted to commodity hedge.

$$E[HR_{i,t}|X_{i,t-1}, H_{i,t} = 1] = X_{i,t-1}\beta + \rho\sigma_u\lambda(Z_{i,t-1}\gamma)] \quad (3.2)$$

Where $HR_{i,t}$ is firms' *hedge ratio* at time t; X_{t-1} is a vector of control variables, including *PastCom*, which is the commodity price growth rate at time *t-1*, *AveHe*, which is the average hedge ratio in industry *j* except firm *i* at time *t-1*, leverage, KZ, debt rating, investment, ROA, dividends ratio, cash holdings, Herfindahl index, log of tax loss carry forward, young CEO dummy, stock compensation ratio and option compensation ratio. $H_{i,t}$ is the binary variable of whether firms hedge predicted in the first stage of Heckman model. $Z_{i,t-1}$ is a vector of instrumental variables defined in chapter 2. $Z_{i,t-1}$ includes firms size, age, hedge other exposures and percentage of hedgers in industry.

Other variables used in this chapter are defined as follows. *Size* is the market value at the end of each year. *Age* is the years since it first appears in CRSP. *R&D expense* is scaled by sales and shown in percentage. *Investment* is the capital expenditure divided by total assets. *Leverage* is the book value of the total debt divided by the total asset. *Long term debt* is the long term debt scaled by the total asset. *Cash holdings* are the cash and cash equivalent investment divided by the total asset. *Current ratio* is current asset divided by current liability. *KZ index* is defined using Lamont, Polk, and Saá-Requejo, (2001) formula. *Operating profit margin* is the gross income divided by total sales. *ROA* is the operating income divided by the total asset. *Q* is the market value of equity plus book value of debt divided by the total assets. *Herfindahl* is the sum of squared market share of the top 50 firms in 3-digit-SIC industry. *Number of firms* is the number of firms in a 3-digit-SIC industry. *Debt Rating* is the index of S&P debt rating,

with 0 means no rating, 1 means under C, 21 means AAA, etc. *LTLCF* is the log of 1+Tax Loss Carry Forward. *Young_CEO* is the dummy variable that equals to one if the age of CEO is less than 45. *Stock Compensation ratio* is value of stock compensation divided by total compensation. *Option Compensation ratio* is the value of options compensation divided by total compensation.

In additional to the base models of the extent of hedging, I also analyze the time series and cross-sectional deviation of hedge ratio. Analyzing these deviations would shed some light on what determines the extent of hedging and what drives managers to deviate from optimal hedge ratio.

To examine the effects of past commodity prices on hedge ratio, the following regressions are conducted.

$$E\left[HR_{i,t}\middle|X_{i,t-1}, PastCom_{i,t-1}, H_{i,t}=1\right] = X_{i,t-1}\beta + X_{i,t-1}\cdot PastCom_{i,t-1}\delta + \rho\sigma_u\lambda(Z_{i,t-1}\gamma) \quad (3.3)$$

Where $HR_{i,t}$ is firms' *hedge ratio* at time t; $PastCom_{i,t-1}$ is the commodity price growth rate at time *t-1*; X_{t-1} is a vector of control variables, including leverage, KZ, debt rating, investment, ROA, dividends ratio, cash holdings, Herfindahl index, log of tax loss carry forward, young CEO dummy, stock compensation ratio and option compensation ratio. $H_{i,t}$ is the binary variable of whether firms hedge predicted in the first stage of Heckman model. $Z_{i,t-1}$ is a vector of instrumental variables defined in chapter 2. $X_{i,t-1}\cdot PastCom_{i,t-1}$ is the interaction terms of firms' characteristics and past commodity price growth rates. The

interaction terms capture the determinants for firms to deviate from their optimal hedge ratio according to the past commodity price growth rate.

To examine the effects of industry average hedge ratio on firms' hedge ratio, the following regressions are conducted.

$$E\left[HR_{i,t}\middle|X_{i,t-1}, AveHe_{i,t-1}, H_{i,t}=1\right] = X_{i,t-1}\beta + X_{i,t-1}\cdot AveHe_{i,t-1}\delta + \rho\sigma_u\lambda(Z_{i,t-1}\gamma) \quad (3.4)$$

Where $HR_{i,t}$ is firms' *hedge ratio* at time t; $AveHe_{i,t-1}$ is the average hedge ratio in industry *j* except firm *i* at time *t-1*; X_{t-1} is a vector of control variables, including leverage, KZ, debt rating, investment, ROA, dividends ratio, cash holdings, Herfindahl index, log of tax loss carry forward, young CEO dummy, stock compensation ratio and option compensation ratio. $H_{i,t}$ is the binary variable of whether firms hedge predicted in the first stage of Heckman model. $Z_{i,t-1}$ is a vector of instrumental variables defined in chapter 2. $X_{i,t-1}\cdot AveHe_{i,t-1}$ is the interaction terms of firms' characteristics and industry hedge ratio. The interaction terms capture the determinants for firms to choose different hedge ratio from its industry average.

3.4 Results

3.4.1 The extent of hedging

The results of the extent of hedging are reported in Table 3.1. I find that debt rating, Young CEO dummy and option compensation ratio are negatively correlated with the extent of hedging. The results are consistent with Tufano (1996) that firms with less risk averse managers hedge less of their exposures. Morin and Suarez (1983), Pålsson (1996) and other

studies on general investor's risk aversion find that the investor's risk aversion increases with age. Cohen, Hall and Viceira (2000) find that CEO age is negatively related to stock price volatility. Gervais and Odean (2001) argue that a trader's expected level of overconfidence is higher in the early stages of his career. Rajgopal, and Shevlin (2002), among others, find empirical evidence on the positive correlation between stock option compensation and risk taking. So, the results suggest that managerial risk preferences play an important role when setting up hedging policies on the extent of hedging, which is different from the decision to hedge, where the most important determinants are firms' ability to hedge.

In addition to the results which are consistent with previous literature, I also find that *PastCom,* which is the past commodity price growth is positively related to the extent of hedging. It suggests that, in general, firms tend to increase their hedge ratio when they observe an increase in commodity price in the previous period. Assuming there is only one optimal hedge ratio for firms with certain characteristics, the results suggest that firms adjust the hedge ratio based on their expectations of future commodity prices. It is consistent with the notion that firms may speculate when setting up the amount of hedging[24].

I also find that firms tend to hedge more when the industry average hedge ratio is higher. It indicates a spillover effect not only on the decisions to hedge, but also on the extent of hedging.

Among all the determinants, past commodity price growth, the industry average hedge ratio and return of assets are the top three important characteristics, followed by young

[24] See Adam and Fernando (2006) and Faulkender (2005) for further evidence on hedging and speculation.

CEO dummy and option compensation ratio. So, the results suggest that managerial risk preferences play an important role when setting up hedging policies on the extent of hedging, which is different from the decision to hedge, where the most important determinants are firms' ability to hedge.

All independent variables are measured at t-1. Model (1)-(2) include year effects; Model (3)-(4) include industry and year effects and Model (5)-(6) include industry by year effects. All models report T-stats calculated using heteroskedasticity adjusted standard errors and clustered at the firm level.

3.4.2 The extent of hedging and past commodity price growth

If the hypothesis that firms with high risk appetite managers tend to hedge less is true, I should find the interaction term of past commodity price growth and young CEOs and the interaction term of past commodity price growth and option compensation ratio are significantly different from zero. On the other hand, it the hypothesis is true, I should also find the interaction terms of past commodity price growth and measures of firms' financial situations are not significantly different from zero.

Table 3.2 reports the results for model 3.3 with the interaction term of past commodity price growth and firms' characteristics. I find that the firms with young CEOs and have higher option compensation ratio decrease their hedge ratios when they observe the past commodity price increases. Firms also tend to inversely respond to past commodity price growth when they are in competitive industries, though the coefficients are only significant at 10% confidence level. Younger CEOs usually are less risk averse compared to older

CEOs because they are in the early stage of their life cycles. The managers with higher option compensation prefer extra volatility of the cash flow and the stock price of the firms. So, their preferences for higher risk make them over confident and develop their hedge ratio according to their expectation to the future commodity prices, based on the past commodity price growth.

It is noteworthy to mention that firms' financial constraint measures, leverage and debt rating and profitability do not affect whether firms deviate their hedge ratios according to the past commodity growth rate. The only significant characteristics that affect firms' hedge ratio deviation on the past commodity growth rate are the young CEO dummy and the option compensation ratio. It indicates that managerial risk preference is the main reason why firms deviates their hedge ratio according to past commodity price growth.

3.4.3 The extent of hedging and industry average hedge ratio

If the hypothesis that firms with high risk appetite managers hedge less and be overconfident is true, I should find the interaction term of and young CEOs and the interaction term of industry average hedge ratio and option compensation ratio are significantly less than zero. On the other hand, it the hypothesis is true, I should also find the interaction terms of past commodity price growth and measures of firms' financial situations are not significantly less than zero.

Table 3.3 reports the results for model 3.3 with the interaction term of industry average hedge ratio and firms' characteristics. It shows that the firms with higher debt rating, young CEO and have higher option compensation ratio tend to be independent from the industry

average hedge ratio. Younger CEOs usually are less risk averse compared to older CEOs because they are in the early stage of their life cycles. The managers with higher option compensation prefer extra volatility of the cash flow and the stock price of the firms. So, their preferences for higher risk make them over confident and develop their hedge ratio different then their competitors.

I also find that firms are more likely to follow the industry average hedge ratio when they are in concentrated industries. In concentrated industries, firms suffer more from predation risk from competitors and it shows in part II of my dissertation that firms who hedge less may suffer more from their competitors if they are in concentrated industries. So, the results showing that firms are more likely to follow the industry average hedge ratio when they are in concentrated industries are consistent with the competition arguments[25].

3.4.4 Industry specific results

Table 3.4 shows the summary statistics of commodity growth rate and its autocorrelation and volatilities for different industries. Metal industries have the lowest commodity price growth rate, average of 8.4%, and highest autocorrelation, average of 0.146.

Table 3.5 reports the results of Tobit regressions of hedge ratio for different industries. I use Tobit instead of Heckman model because a single industry does not have enough statistical power to conduct Heckman two-stage model. It shows that for airline industry

[25] It is also consistent with the findings in Haushalter, Klasa and Maxwell (2007) that firms tend to hedge more when they share similar investment opportunities with their competitors.

(two digit SIC 45) and other industries[26], past commodity price growth, firm size and stock compensation ratio are positively associated with the extent of hedging. For metal industries (two digit SIC 33 and 34), past commodity price growth negatively affect the extent of hedging, while for petroleum refining industry (two digit SIC 29), past commodity price growth does not significantly affect the hedge ratio. Option compensation ratios are significant for all industries, except for airline industry.

The results show that there exist a great amount of heteroskedasticity in industries and the industry effects are necessary to control for industry specific results. To distinguish firm effects from industry effects, firm fixed effect regressions on the extent of hedging are conducted industry by industry. The results are reported in Table 3.6. Firm fixed effect regressions show similar results to the Tobit regressions with lower statistical significance.

3.5 Conclusions

In this chapter, I investigate the factors that associate with the extent of corporate risk management. The data sample in my dissertation has advantages to overcome the concerns on using gross notional value as a measure of the extent of hedging. First, this chapter focuses on commodity hedging, which does not suffer the reporting problems mentioned in Allayannis and Ofek (2001). Second, my sample consists of commodity-input industries whose hedging activities are mainly on their input commodity exposures. These firms are

[26] Other industries include textile industry (two digit SIC 22), lumber industry (two digit SIC 24), furniture industry (two digit SIC 25) and paper industry (two digit SIC 26).

less likely to hold offsetting contracts for their commodity hedging. Therefore, the measures on the extent of hedging I use in my dissertation are less subject to overestimation bias. Third, because my sample consists of commodity-input industries, I can scale the gross notional value of the derivatives contracts by the cost of goods sold (COGS) to measure the percentage of commodity exposures being hedged directly. By contrast, the literature usually scales the gross notional value of the derivatives contracts by total assets, which does not directly capture the exposures of commodity price risk.

I examine the hedging policies of 579 firms in 10 industry groups over the policies of 579 firms in 10 industry groups over the period of 1994-2008. Specifically, I find that firms with younger CEOs and have more options in their compensation plans hedge less of their exposures. The results suggest that managerial risk preference play an important role in setting up the extent of hedging. The results are consistent with Tufano (1996), which analyzing the hedging activities in the gold mining industry in 1986.

Furthermore, I find that the hedge ratio is positively correlated with the past commodity price growth rate. The firms with higher debt ratio, young CEO and higher option compensation are more likely to form their hedge ratios according to the past commodity price growth. It suggests that firms may deviate from the optimal hedge ratio according to past commodity price growth and managers with higher risk appetite are more likely to deviate. I also find that firms' hedge ratio is higher when the average hedge ratio in industry is higher. It suggests that there is a spillover effect on the extent of hedging. The results are also consistent with the notion that competition in the product market affects corporate risk

management. Interestingly, I find that the firms with higher debt ratio, young CEO and higher option compensation are more likely to deviate from industry average hedge ratio. It suggests that firms may deviate from the optimal hedge ratio in the cross-section from their industry average and managers with higher risk appetite are more likely to deviate.

Table 2.1 List of industry groups and summary of hedging policies

The table lists the sample of industry groups at 2-digit SIC level in the paper. *Number of firms* is the average number of firms in 3-digit-SIC industry. *Herfindahl* index is the sum of squared market share in 3-digit-SIC industry. *Natural hedge* is identified when a firm states in the filings that it uses long-term contracts with either supplier or consumers to fix the price for at least one year. *Hedge ratio* is either firms stated percentage of anticipated commodity usage hedged or the stated notional dollar amount divided by Cost of Goods Sold (COGS). The sample period is 1994-2008.

Industry group	Name	Number of 3-digit-SIC industries	Average number of firms per industry	Average Industry Herfindahl	percentage number of firms hedge					
					Any form of hedge	Interest rate hedge	Exchange rate hedge	Commodity hedge	Natural hedge	Average commodity hedge ratio
21	Tobacco Products	1	5.4	0.74	0.45	0.15	0.30	0.00	0.25	0.00
22	Textile Mill Products	4	5.6	0.39	0.60	0.43	0.23	0.20	0.00	0.02
24	Lumber And Wood Products, Except Furniture	3	8.0	0.39	0.20	0.12	0.03	0.05	0.00	0.00
25	Funitures	4	5.8	0.34	0.33	0.30	0.15	0.00	0.00	0.00
26	Paper And Allied Products	5	23.0	0.26	0.38	0.31	0.23	0.29	0.00	0.08
29	Petroleum Refining	2	17.1	0.33	0.66	0.20	0.21	0.49	0.00	0.03
33	Primary Metal	1	14.8	0.39	0.45	0.25	0.25	0.26	0.02	0.00
34	Fabricated Metal Products	6	7.4	0.38	0.44	0.24	0.25	0.09	0.06	0.01
37	Transportation Equipment	7	17.9	0.50	0.46	0.27	0.39	0.08	0.00	0.00
45	Transportation By Air	1	16.6	0.19	0.78	0.16	0.14	0.72	0.30	0.22
Average		3.40	12.16	0.39	0.48	0.24	0.22	0.22	0.06	0.04
Total		34								

Table 2.2 Summary statistics of firms grouped by hedging frequency

The table shows the median values of the characteristics of firms grouped by hedging frequency. *No Hedge* are firms with zero hedge ratio. *Minor hedge* are firms with hedge ratio less than the industry median. *Extensive hedge* are firms with hedge ratio higher than industry median. *Size* is the market value at the end of each year. *Age* is the years since it first appears in CRSP. *R&D expense* is scaled by sales and shown in percentage. *Investment* is the capital expenditure divided by total assets. *Leverage* is the book value of the total debt divided by the total asset. *Long term debt* is the long term debt scaled by the total asset. *Cash holdings* are the cash and cash equivalent investment divided by the total asset. *Current ratio* is current asset divided by current liability. *KZ index* is defined using Lamont, Polk, and Saá-Requejo, (2001) formula. *Operating profit margin* is the gross income divided by total sales. *ROA* is the operating income divided by the total asset. *Q* is the market value of equity plus book value of debt divided by the total assets. *Herfindahl* is the sum of squared market share of the top 50 firms in 3-digit-SIC industry. *Number of firms* is the number of firms in 3-digit-SIC industry. The sample period is 1994-2008. The data is from Compustat. *** indicates 1% significance level, ** indicates 5% significance level and * indicates 10% significance level.

	No hedge		Minor hedge		Extensive hedge		T-stat of the difference between No hedge and Minor hedge	T-stat of the difference between Minor hedge and Extensive hedge
	Mean	Median	Mean	Median	Mean	Median		
N	3268		1543		1544			
Size (in millions)	3575.5	103.9	4165.8	1199.9	3338.0	689.1	-0.95	2.96
Age (years)	16.4	12.0	31.2	30.5	22.6	18.0	-28.43	14.06
Leverage	0.303	0.280	0.279	0.212	0.327	0.312	3.41	-7.02
Long term debt	0.233	0.206	0.213	0.186	0.286	0.278	3.17	-11.65
Cash holdings	0.062	0.026	0.070	0.044	0.080	0.045	-2.80	-3.08
Current Ratio	2.352	1.985	2.098	2.043	1.553	1.213	6.03	17.50
KZ Index	0.647	0.871	0.556	0.631	0.971	1.021	2.03	-11.88
KZ Index without Q	0.326	0.571	0.193	0.284	0.620	0.707	2.89	-11.87
R&D expense	0.005	0.000	0.003	0.000	0.001	0.000	3.64	13.35
Investment	0.066	0.046	0.051	0.038	0.088	0.070	8.57	-17.32
Operation profit	0.080	0.090	0.139	0.125	0.101	0.106	-16.93	12.41
ROA	0.049	0.077	0.101	0.085	0.068	0.071	-11.61	10.04
Q	1.451	1.147	1.364	1.322	1.270	1.145	3.03	4.89
Sales growth	1.099	1.064	1.160	1.120	1.123	1.083	-6.25	4.16
Herfindahl	0.235	0.160	0.295	0.195	0.132	0.091	-8.03	24.06
Number of firms	21.0	18.0	16.5	10.0	27.2	30.0	8.83	-24.13
Female CEO	0.013	0.000	0.000	0.000	0.013	0.000	5.18	-4.46
CEO age under 45	0.084	0.000	0.000	0.000	0.047	0.000	13.72	-8.69
CEO age above 60	0.303	0.000	0.556	1.000	0.285	0.000	-15.29	15.56
CEO tenure	7.252	5.000	5.722	4.500	6.281	4.000	7.75	-2.73
Option compensation	0.214	0.153	0.372	0.304	0.155	0.137	-7.46	5.68
Stock compensation	0.028	0.000	0.052	0.000	0.065	0.000	-7.01	-2.53

Table 2.3 Pearson correlation of variables

The table shows the Pearson correlation of variables. *Size* is the market value at the end of each year. *Age* is the years since it first appears in CRSP. *R&D expense* is scaled by sales and shown in percentage. *Investment* is the capital expenditure divided by total assets. *Leverage* is the book value of the total debt divided by the total asset. *Long term debt* is the long term debt scaled by the total asset. *Cash holdings* are the cash and cash equivalent investment divided by the total asset. *Current ratio* is current asset divided by current liability. *KZ index* is defined using Lamont, Polk, and Saá-Requejo, (2001) formula. *Operating profit margin* is the gross income divided by total sales. *ROA* is the operating income divided by the total asset. *Q* is the market value of equity plus book value of debt divided by the total assets. *Herfindahl* is the sum of squared market share of the top 50 firms in 3-digit-SIC industry. *Number of firms* is the number of firms in 3-digit-SIC industry. The sample period is 1994-2008.

	Size	Age	Leverage	Debt rating	Cash	KZ Index	R&D expense	Investment	ROA	Herfindahl	CEO age under 45	CEO tenure	Option ratio	Stock ratio
Size (in millions)	1.00													
Age (years)	0.26	1.00												
Leverage	-0.19	-0.16	1.00											
Debt rating	0.36	0.47	-0.06	1.00										
Cash holdings	0.02	-0.08	-0.22	-0.10	1.00									
KZ Index	-0.27	-0.29	0.76	-0.22	-0.14	1.00								
R&D expense	0.00	0.01	-0.14	0.06	-0.01	-0.13	1.00							
Investment	0.04	-0.04	-0.09	0.04	0.03	-0.01	-0.17	1.00						
ROA	0.17	-0.01	-0.34	0.03	0.16	-0.33	0.02	0.13	1.00					
Herfindahl	-0.07	-0.11	0.03	-0.16	-0.04	0.00	0.33	-0.22	0.07	1.00				
CEO age under 45	-0.05	-0.14	-0.01	-0.18	0.06	0.02	-0.03	0.16	-0.02	0.02	1.00			
CEO tenure	-0.04	-0.13	-0.02	-0.10	0.01	0.04	-0.11	0.09	0.13	0.00	-0.06	1.00		
Option compensation ratio	0.00	0.09	0.07	-0.05	-0.05	0.07	0.02	0.19	-0.07	-0.10	0.01	-0.04	1.00	
Stock compensation ratio	0.24	0.17	-0.05	0.11	0.11	-0.05	-0.03	-0.02	0.16	0.04	-0.04	0.01	-0.28	1.00

Table 2.4 Transition Matrix of firms hedging policies

The table shows the Transition Matrix of firms' hedging policies. Panel A and B report the average percentage of firms transit from Not Hedge (Hedge) at time *t-1* to Not Hedge and Hedge at time *t*. In Panel A, hedge equals to 1 when firms conduct any type of hedge and in Panel B, hedge equals to 1 when firms conduct commodity hedge. Panel C reports the average percentage of firms transit from No Hedge (Some Hedge or More Hedge) at time *t-1* to No Hedge, Some Hedge and More Hedge at time *t*. *No Hedge* are firms with zero hedge ratio. *Some hedge* are firms with hedge ratio less than the industry median. *More hedge* are firms with hedge ratio higher than industry median. The sample period is 1994-2008.

Panel A. Any type of hedge

	Not Hedge $_{t}$	Hedge $_{t}$
Not Hedge $_{t-1}$	0.81	0.19
Hedge $_{t-1}$	0.08	0.92

Panel B. Commodity Hedge

	Not Hedge $_{t}$	Hedge $_{t}$
Not Hedge $_{t-1}$	0.90	0.10
Hedge $_{t-1}$	0.09	0.91

Panel C. Commodity Hedge

	No Hedge $_{t}$	Some Hedge $_{t}$	More Hedge $_{t}$
No Hedge $_{t-1}$	0.90	0.03	0.07
Some Hedge $_{t-1}$	0.28	0.61	0.11
More Hedge $_{t-1}$	0.01	0.03	0.96

Table 2.5 Decision of hedging

The table shows Probit regressions of decisions on commodity hedging. *OtherHe* is dummy variable that equals to 1 when firms ever hedge other type of exposure in the past. # *Hedgers in industry* is percentage number of firms that hedge in the industry except firm itself. *Rating* is the index of debt rating, with 0 means no rating, 1 means under C, 21 means AAA, etc. Other variables are defined in Table 2. All independent variables are measured at t-1. All models report T-stats that are clustered at the firm level and calculated using heteroskedasticity adjusted standard errors. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Log of size	0.107***	0.102**	0.141***	0.101**	0.151***	0.202***
	(2.80)	(2.43)	(2.91)	(2.08)	(2.77)	(3.21)
Age	-0.000	-0.004	0.001	-0.006	0.002	-0.009
	(-0.03)	(-1.10)	(0.16)	(-1.38)	(0.47)	(-1.60)
OtherHe		0.148***		0.153**		0.182**
		(2.64)		(2.25)		(2.33)
# hedgers in industry	0.672***		1.110***		1.234***	1.495***
	(4.20)		(3.45)		(3.04)	(3.00)
Leverage	0.259		0.158		0.129	
	(0.86)		(0.48)		(0.38)	
KZ		-0.101**		-0.087**		-0.132**
		(-2.48)		(-1.95)		(-2.18)
Debt rating	0.001		0.024**		0.060**	
	(1.00)		(2.20)		(2.48)	
Rating < BBB		-0.040**		-0.055**		-0.061*
		(-2.25)		(-2.03)		(-1.93)
Cash holdings	-0.427	-0.059	-0.241	-0.232	-0.292	-0.511
	(-1.61)	(-1.09)	(-1.45)	(-1.27)	(-1.36)	(-1.50)
Investment	0.274	0.301	0.092	0.182	0.512*	0.346
	(1.43)	(1.52)	(1.16)	(1.30)	(1.85)	(1.50)
HHI	-0.638*	-0.923**	-0.885*	-1.333**		
	(-1.94)	(-2.38)	(-1.90)	(-2.38)		
Log of TLCF	-0.003	-0.008	0.001	-0.014	-0.003	-0.009
	(-0.19)	(-0.42)	(0.03)	(-0.55)	(-0.14)	(-0.30)
Young CEO	-0.089		-0.128		-0.120	
	(-0.46)		(-0.69)		(-0.68)	
CEO tenure		0.010		0.013*		0.017*
		(1.45)		(1.69)		(1.95)
Stock comp ratio	0.071	0.060*	0.036*	0.034*	0.052	0.052
	(1.30)	(1.69)	(1.86)	(1.85)	(1.60)	(1.57)
Option comp ratio	-0.175*	-0.177*	-0.103*	-0.108*	-0.163*	-0.161
	(-1.79)	(-1.77)	(-1.85)	(-1.90)	(-1.65)	(-1.62)
Year Effect	Y	Y	Y	Y		
Industry Effect			Y	Y		
Year X Industry Effect					Y	Y
Observations	3031	3012	2914	2894	2856	2835
Pseudo R2	0.242	0.269	0.304	0.300	0.284	0.356
Log pseudolikelihood	-158.7	-126.3	-140.3	-111.1	-126.6	-89.24

Table 2.6 Regressions of hedging for the first time

The table shows Probit regressions of hedging for the first time, where dependent variable is the dummy variable if firms hedge for the first time. # *hedgers in industry* is percentage number of firms hedge in the industry except firm itself. Other variables are defined in Table 2. All independent variables are measured as changes at t-1 except for *age*, # *hedgers in industry* and *Young CEO dummy*. All models report T-stats that are clustered at the firm level and calculated using heteroskedasticity adjusted standard errors. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Log of size	0.018	0.021	-0.002	-0.010	-0.000	-0.000
	(1.37)	(1.26)	(-0.80)	(-0.43)	(-0.55)	(-0.72)
Age	-0.001	-0.001	-0.000*	-0.001	-0.000	-0.000
	(-1.40)	(-1.20)	(-1.84)	(-1.55)	(-1.27)	(-0.68)
# hedgers in industry	0.021	0.024	0.011	0.112		
	(0.76)	(0.83)	(1.26)	(1.29)		
Leverage	0.007**		0.006**		0.001**	
	(2.08)		(2.26)		(2.22)	
KZ		-0.009*		-0.004**		-0.001*
		(-1.857)		(-1.98)		(-1.78)
Debt rating	0.122***	0.131***	0.114**	0.125**	0.115***	0.116***
	(3.57)	(3.56)	(2.44)	(2.38)	(8.40)	(8.23)
Cash holdings	-0.025	-0.030	0.016	0.075	-0.004	-0.007
	(-0.21)	(-0.24)	(0.70)	(0.35)	(-0.40)	(-0.67)
Investment	0.075	0.089	0.010	0.157	0.003	0.005
	(0.67)	(0.74)	(0.77)	(1.33)	(0.86)	(1.24)
ROA	0.632***	0.677***	0.427**	0.402**	0.574*	0.568*
	(3.55)	(3.71)	(2.10)	(2.18)	(1.86)	(1.72)
HHI	0.145**	0.157**	0.104**	0.163**		
	(2.14)	(2.17)	(2.25)	(2.29)		
Log of TLCF	-0.005	-0.005	0.000	-0.004	-0.000	-0.000
	(-0.89)	(-0.85)	(0.33)	(-0.50)	(-0.91)	(-0.83)
Young CEO	0.053	0.055	0.027	0.253	-0.000	0.000
	(1.08)	(1.07)	(1.06)	(1.35)	(-0.08)	(0.05)
Stock comp ratio	0.029**	0.032**	0.033**			
	(1.99)	(2.16)	(2.59)			
Option comp ratio	-0.025**	-0.021**	-0.024**	-0.020**	-0.014**	-0.014**
	(-2.42)	(-2.37)	(-2.15)	(-2.58)	(-2.22)	(-2.39)
Year Effect	Y	Y	Y	Y		
Industry Effect			Y	Y		
Year X Industry Effect					Y	Y
Observations	3031	3012	2914	2894	2856	2835
Pseudo R2	0.209	0.205	0.404	0.392	0.410	0.427
Log pseudolikelihood	-47.97	-47.48	-28.15	-28.49	-24.39	-23.33

Table 2.7 Decisions to hedge industry by industry

The table shows Probit regressions of firms' hedge decisions. Independent variables are defined in Table 2 and 3. All independent variables are measured at t-1. All models report T-stats that are clustered at the firm level and calculated using heteroskedasticity adjusted standard errors. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)
	Airlines	Petroleum Refining	Metals	Others	Others
Log of size	0.161**	0.765**	0.108**	0.273***	0.000***
	(2.12)	(1.99)	(2.14)	(3.33)	(4.32)
Age	-0.003	0.095	0.002	-0.008	-0.000***
	(-0.70)	(1.59)	(0.32)	(-1.03)	(-3.21)
# hedgers in industry			13.608**	2.722***	0.003***
			(2.39)	(4.76)	(4.50)
Leverage	0.358	-0.856	0.327	-1.706***	-0.001***
	(1.52)	(-1.25)	(0.53)	(-3.05)	(-4.41)
Debt rating	0.012**	0.378**	0.008	0.301***	0.258**
	(2.17)	(2.01)	(0.45)	(3.10)	(2.45)
Cash holdings	0.276	-6.935*	-1.146	-9.157***	-0.009***
	(0.42)	(-1.87)	(-0.77)	(-2.68)	(-3.25)
Investment	0.455	-0.992	2.094	-2.944	-0.005*
	(0.79)	(-1.06.)	(0.86)	(-1.54)	(-1.77)
Log of TLCF	-0.003	-0.407	0.002	0.035	-0.000
	(-0.10)	(.)	(0.07)	(0.95)	(-1.01)
Young CEO	-0.575**		-0.482	-0.285	-0.075
	(-2.06)		(-0.64)	(-0.84)	(-1.56)
Stock comp ratio	1.701**		1.011	0.3581	
	(2.15)		(1.05)	(1.21)	
Option comp ratio	-0.740**	0.546	-0.967	-0.609**	-0.078*
	(-2.13)	(1.26)	(-1.07)	(-2.38)	(-1.66)
Year Effect	Y	Y	Y	Y	Y
Industry Effect					Y
Observations	488	539	2401	1031	1031

Table 3.1 Extent of hedging

The table shows second stage Heckman selection regressions of firms' hedge ratio. *PastCom* is the commodity price growth rate at t-1. *AveHe* is the average hedge ratio in industry. Other variables are defined in Table 2. All independent variables are measured at t-1. All models report T-stats that are clustered at the firm level and calculated using heteroskedasticity adjusted standard errors. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
PastCom	0.511***	0.456**	0.532**	0.479**		
	(2.58)	(2.25)	(2.53)	(2.22)		
AveHe	0.916***	0.883***	0.915***	0.927***		
	(6.42)	(6.06)	(4.50)	(4.62)		
Leverage	-0.171		-0.173		-0.405*	
	(-0.87)		(-0.81)		(-1.78)	
KZ		-0.021		-0.023		
		(-0.42)		(-0.41)		
Debt rating	-0.004*		-0.003		-0.004	-0.005*
	(-1.69)		(-1.44)		(-1.58)	(-1.68)
Cash holdings	-0.674*	-0.738*	-0.688*	-0.782**	-0.834**	-0.832**
	(-1.72)	(-1.93)	(-1.75)	(-2.07)	(-1.98)	(-2.02)
HHI	0.245	0.149	0.296	0.344		
	(0.70)	(0.47)	(0.61)	(0.78)		
Log of TLCF	-0.011	-0.006	-0.008	-0.002	-0.009	-0.001
	(-0.82)	(-0.48)	(-0.58)	(-0.17)	(-0.52)	(-0.03)
Young CEO	-0.676**		-0.709**		-0.716**	
	(-2.52)		(-2.61)		(-1.99)	
CEO tenure		0.008**		0.008**		0.010***
		(2.01)		(2.12)		(2.99)
Stock comp ratio	0.060	0.073	0.052	0.060	-0.017	0.003
	(0.33)	(0.42)	(0.29)	(0.35)	(-0.08)	(0.02)
Option comp ratio	-0.105**	-0.124**	-0.115**	-0.141**	-0.086**	-0.092**
	(-2.30)	(-2.25)	(-2.01)	(-1.99)	(-2.42)	(-2.47)
Lambda	-0.189**	-0.168**	-0.175*	-0.150*	-0.206**	-0.210**
	(-2.16)	(-2.06)	(-1.87)	(-1.90)	(-2.18)	(-2.15)
Constant	0.193	-0.039	0.150	-0.139	0.747*	-0.234
	(1.08)	(-0.17)	(0.56)	(-0.47)	(1.76)	(-0.69)
Year Effect	Y	Y	Y	Y		
Industry Effect			Y	Y		
Year X Industry					Y	Y
Observations	3031	3012	2914	2894	2856	2835

Table 3.2: Extent of hedging with interactions with past commodity price growth

The table shows second stage Heckman selection regressions of firms' hedge ratio. Independent variables are defined in Table 2 and 3. All independent variables are demeaned and measured at t-1. All models report T-stats that are clustered at the firm level and calculated using heteroskedasticity adjusted standard errors. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
PastCom	0.639***	0.633***	0.687***	0.691***	0.537***	0.623**
	(2.73)	(2.68)	(2.86)	(2.94)	(2.60)	(2.47)
AveHe	0.896***	0.880***	0.920***	0.917***	0.935***	0.952***
	(6.51)	(6.23)	(5.19)	(5.27)	(4.75)	(5.15)
Leverage	-0.167	-0.182	-0.150	-0.153	-0.060	-0.140
	(-0.77)	(-0.82)	(-0.67)	(-0.70)	(-0.23)	(-0.66)
*PastCom * leverage*	-0.933				-1.093	
	(-1.35)				(-1.56)	
Debt rating	-0.153**	-0.150**	-0.163**	-0.160**	-0.175**	-0.145**
	(-2.00)	(-2.02)	(-2.18)	(-2.27)	(-2.08)	(-2.15)
*PastCom * rating*		-0.146	-0.111	-0.115		-0.106
		(-0.67)	(-0.52)	(-0.56)		(-0.49)
Cash holdings	-0.816*	-0.806*	-0.856*	-0.870**	-0.768	-0.896**
	(-1.75)	(-1.73)	(-1.91)	(-2.02)	(-1.58)	(-2.16)
HHI	0.470	0.434	0.714	0.701	0.793	0.665
	(1.23)	(1.14)	(1.53)	(1.56)	(1.53)	(1.44)
*PastCom * HHI*	-0.624*		-0.751**	-0.756**		
	(-1.92)		(-2.15)	(-2.18)		
Log of TLCF	-0.005	-0.004	0.000	0.000	-0.002	0.001
	(-0.33)	(-0.24)	(0.02)	(0.02)	(-0.12)	(0.10)
Young CEO	-0.765	-0.684	-0.680	-0.697	-0.631	-0.700
	(-2.35)	(-2.38)	(-2.11)	(-1.90)	(-2.15)	(-1.94)
*PastCom * young CEO*	-0.038		-0.110		-0.454	
	(-2.05)		(-2.14)		(-2.03)	
Stock comp ratio	0.070	0.065	0.055	0.055	0.063	0.046
	(0.34)	(0.31)	(0.28)	(0.28)	(0.28)	(0.25)
Option comp ratio	-0.048	-0.098	-0.062	-0.067	-0.071	-0.149
	(-0.28)	(-0.55)	(-0.38)	(-0.43)	(-0.39)	(-0.92)
*PastCom * option comp*		-0.220				-0.245
		(-0.52)				(-0.63)
lambda	-0.266***	-0.272***	-0.252***	-0.249***	-0.285**	-0.214**
	(-2.72)	(-2.83)	(-2.59)	(-2.73)	(-2.55)	(-2.38)
Constant	0.351*	0.368*	0.251	0.246	0.368	0.218
	(1.78)	(1.84)	(1.00)	(1.00)	(1.32)	(0.89)
Year Effect	Y	Y	Y	Y	Y	Y
Industry Effect			Y	Y	Y	Y
Observations	3031	3031	2810	2810	2810	2810

Table 3.3 Extent of hedging with interactions of industry average hedge ratio

The table shows second stage Heckman selection regressions of firms' hedge ratio and interaction terms of industry average hedge ratio (*AveHe)* and firms' characteristics. Independent variables are defined in Table 2 and 3. All independent variables are demeaned and measured at t-1. All models report T-stats that are clustered at the firm level and calculated using heteroskedasticity adjusted standard errors. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
PastCom	0.553***	0.510**	0.491**	0.531***	0.486**	0.485**
	(2.67)	(2.55)	(2.47)	(2.62)	(2.40)	(2.34)
AveHe	0.855*	0.841**	0.761**	0.767**	0.740**	0.770***
	(1.94)	(2.16)	(2.25)	(2.10)	(2.49)	(2.29)
Leverage	-0.188	-0.239	-0.336	-0.190	-0.301	-0.187
	(-0.72)	(-1.11)	(-1.03)	(-0.88)	(-0.93)	(-0.85)
*AveHe * Leverage*	1.300		1.022		0.864	
	(0.81)		(0.59)		(0.50)	
Debt rating	-0.010	-0.007		-0.011		-0.011
	(-1.20)	(-1.06)		(-1.26)		(-1.32)
*AveHe * rating*		0.022		0.053		0.043
		(0.81)		(1.55)		(1.25)
Cash holdings	-0.487	-0.652	-0.610	-0.708*	-0.604	-0.696*
	(-0.96)	(-1.61)	(-1.44)	(-1.78)	(-1.43)	(-1.72)
HHI	-0.097	0.251	-1.976	0.582	-0.009	0.788
	(-0.08)	(0.65)	(-0.91)	(0.23)	(-0.02)	(1.25)
*AveHe * HHI*	-3.383*		-3.019*	-3.290**		
	(-1.69)		(-1.95)	(-2.13)		
Log of TLCF	-0.007	-0.011	-0.007	-0.009	-0.009	-0.011
	(-0.44)	(-0.79)	(-0.44)	(-0.61)	(-0.61)	(-0.79)
Young CEO	-0.750*	-0.758**	-0.661*	-0.663**	-0.657*	-0.651**
	(-1.83)	(-2.43)	(-1.69)	(-2.47)	(-1.71)	(-2.37)
*AveHe * young CEO*	-0.578**		-0.577**		-0.551**	
	(-2.17)		(-2.33)		(-2.39)	
Stock comp ratio	0.039	0.058	0.046	0.050	0.055	0.057
	(0.17)	(0.31)	(0.24)	(0.28)	(0.29)	(0.31)
Option comp ratio	-0.139**	-0.110**	-0.117**	-0.106**	-0.100**	-0.109**
	(-2.21)	(-2.05)	(-2.41)	(-2.48)	(-2.64)	(-2.05)
*AveHe * option comp*		-0.587*				-0.578**
		(-1.87)				(-1.98)
lambda	-0.294**	-0.221**	-0.218**	-0.188*	-0.210**	-0.206**
	(-2.00)	(-2.30)	(-2.05)	(-1.93)	(-1.98)	(-2.00)
Constant	0.453	0.356*	0.303	0.594	0.331	0.587
	(1.61)	(1.86)	(1.42)	(1.50)	(1.56)	(1.57)
Year Effect	Y	Y	Y	Y	Y	Y
Industry Effect			Y	Y	Y	Y
Observations	3031	3031	2810	2810	2810	2810

Table 3.4 Summary Statistics industry by industry

The table shows summary statistics of firm and industry characteristics industry by industry. Volatility of PastCom is the standard deviation of past commodity growth. Variables are defined in Table 2 and 3.

	(1)	(2)	(3)	(4)
	Airlines	Petroleum Refining	Metals	Others
Past commodity growth	0.146	0.134	0.084	0.150
Size	1960.1	26414.5	1392.9	2858.3
Leverage	0.312	0.265	0.288	0.325
Cash holdings	0.115	0.045	0.050	0.075
Option comp ratio	0.325	0.244	0.213	0.166
Volatility of PastCom	0.267	0.229	0.211	0.188
Autocorrelation of PastCom	0.022	0.062	0.146	0.010
Observations	488	539	2401	1031

Table 3.5 Extent of hedging industry by industry

The table shows Tobit regressions of firms' hedge ratio. Independent variables are defined in Table 2 and 3. All independent variables are measured at t-1. All models report T-stats that are clustered at the firm level and calculated using heteroskedasticity adjusted standard errors. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)
	Airlines	Petroleum Refining	Metals	Others
PastCom	0.222**	0.076	-0.830**	0.038**
	(1.98)	(1.27)	(-2.09)	(2.11)
Log of Size	0.083***	-0.014	0.037	0.131*
	(3.42)	(-1.34)	(1.66)	(1.79)
Leverage	0.539**	-0.079	0.095	1.041
	(2.47)	(-0.36)	(0.42)	(1.20)
Cash holdings	0.483	0.122	-0.117	-3.787
	(1.25)	(0.17)	(-0.21)	(-1.00)
ROA	-0.065	-0.353	-1.272**	-3.236
	(-0.14)	(-0.78)	(-2.10)	(-1.26)
Stock comp ratio	0.052**			0.328
	(2.31)			(1.28)
Option comp ratio	-0.019	0.136*	-0.357**	-0.358***
	(-0.14)	(2.03)	(-2.45)	(-3.26)
Constant	-0.612***	0.110	-0.117	-1.592**
	(-2.72)	(0.82)	(-0.77)	(-2.43)
Year Effect	Y	Y	Y	Y
Industry Effect				
Observations	488	539	2401	1031

Table 3.6 Extent of hedging industry by industry—firm fixed effect

The table shows Firm fix effect regressions of firms' hedge ratio. Independent variables are defined in Table 2 and 3. All independent variables are measured at t-1. All models report T-stats that are clustered at the firm level and calculated using heteroskedasticity adjusted standard errors. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)
	Airlines	Petroleum Refining	Metals	Others
PastCom	0.148*	0.021**	-0.013	0.037*
	(1.88)	(1.98)	(-0.11)	(1.84)
Log of Size	0.132***	0.002	0.022	0.004
	(4.94)	(0.27)	(0.64)	(0.22)
Leverage	0.283	-0.051	0.068	0.090
	(1.41)	(-0.55)	(0.32)	(0.51)
Cash holdings	0.105	-0.150	0.034	-0.283
	(0.31)	(-1.20)	(0.05)	(-0.58)
Stock comp ratio	-0.100			0.025
	(-0.86)			(0.19)
Option comp ratio	-0.205**	-0.040*	-0.052*	-0.022*
	(-2.15)	(-1.89)	(-1.77)	(-1.68)
Constant	-0.686***	0.012	-0.127	0.010
	(-3.29)	(0.16)	(-0.49)	(0.07)
Observations	488	539	2401	1031
R-squared	0.202	0.763	0.078	0.014

Part II Corporate Risk Management and Product Market Competition

Chapter 4
Corporate Risk Management and Commodity Price Shocks

4.1 Introduction

In 2000, jet fuel prices increased by over 70%. During a three-year period beginning in 2000, United Airlines (UAL), which hedged less than 10% of its jet fuel exposure ex ante, experienced a 22.6% loss in market share and a 32% loss in relative profitability. By contrast, Southwest Airlines, which hedged 80% of its exposure, experienced a market share increase of 27% and an increase of 22% in relative profitability. Interestingly, Southwest Airlines also increased its advertising expenditure by 13% in 2000 and 2001. It indicates that Southwest takes advantage of the financial distress of United induced by its less hedged exposure in jet fuel and competes more aggressively for market share.

This chapter studies the relationship between corporate hedging and product market competition and focuses on how firms with different hedging policies respond to unfavorable commodity shocks in the product market competition. Specifically, this chapter uses a broad sample of commodity-inputs industries to investigate whether a commodity shock has a long term effect on unhedged firms.

Using a panel data of 579 firms (6276 observations) over the period of 1994-2008, I find evidence that firms' hedging policies affect product market competition outcomes.

Specifically, I find that unhedged firms lose market share and profitability after negative commodity shocks. These effects are persistent for up to five years after the shock. I also find that when I condition the results on firms' ex ante financial constraints, unhedged and constrained firms lose the most of their market share and profitability. The effects are stronger in concentrated industries and industries with higher leverage dispersion. I adopt a difference-in-difference approach and shock indicators to control for the performance trends and use an instrumental variable methodology to address the potential endogeneity of hedging policies and financial constraints.

The chapter directly relates to the recent literature that examines the strategic usage of corporate risk management. Froot, Scharfstein, and Stein (1993) argue that a shock that reduces cash flows can render an unhedged firm unable to finance its investment opportunities, thus losing market share to rivals that hedged against this shock and can fund this investment internally. Similarly, Mello and Ruckes (2005) suggest that firms tend to hedge different risks from its competitors in order to gain in the product market competition in a favorable shock. Adam, Dasgupta and Titman (2007) argue that firms' hedging choices depend on the hedging choices of their competitors. Several empirical papers provide evidence that firms consider product market competition when they make hedging decisions. Haushalter, Klasa and Maxwell (2007) study the S&P 500 manufacturing firms from 1993 to 1997 and find that the derivatives usage and cash holdings are positively correlated with the interdependence of investment opportunities with rivals. Nain (2004) finds that a firm is more likely to engage in foreign currency risk-management if many competitors are doing so.

Similarly, Adam and Nain (2008) find that there are fewer derivatives users in industries with higher competition. My dissertation is the first to provide direct evidence that ex ante hedging policies affect product market competition outcomes in a long term event study setting. My dissertation is also the first that studies commodity hedging in a multiple industries setting.

The rest of the chapter is organized as follows. Section 4.2 describes the data used in this chapter. Section 4.3 describes the methodologies and presents the results. Section 4.4 concludes the chapter.

4.2 Data

4.2.1 Hedging data

The sample consists of manufacturing and the airline industries which have hedgeable commodities as significant inputs components. I identify industries with commodity inputs using U.S. Bureau of Economic Analysis (BEA) benchmark input-output tables in 2002. I rank the percentage of commodity usage in each industry's total inputs, where commodities are defined as 30 hedgable commodities traded on the Chicago Merchandise Exchange, the Chicago Board of Trade and the New York Merchandise Exchange. I pick the top 10 two-digit-SIC industries and exclude 3-digit-SIC industries with more than 200 firms considering the fact that predation is less likely to happen in highly competitive markets and the cost of collecting hedge data. The list of two-digit-SIC industries is reported in Table 4.1.

The sample covers the period of 1994-2008 because SEC electronic data becomes available in 1994. The sample consists of 976 firms and 31 three-digit-SIC industries. I exclude: (1) firms without 10-K or 10-Q forms in SEC EDGAR, (2) firms with less than three years of data after the commodity shock[27], (3) firms with negative sales or asset data during the sample period, (4) industries with only one firm. After applying the above rules, I obtain the final sample of 579 firms, 6276 firm-year observations. I compare the characteristics of the final sample used in this paper, of all manufacturing firms and of all Compustat firms. The summary statistics of different samples are reported in Appendix B. The final sample used in the paper consists of more mature and larger firms, firms with lower R&D expenses, higher financial constraints and higher industry concentration.

Hedging data are hand collected with keyword searching in 10-K forms from SEC EDGAR. The keywords used include: "hedg", "derivative", "market risk" and "raw material". Then the paragraph around the keywords is read to identify whether it is a hedge, what kind of hedge it is[28], what kind of derivatives they use, the notional value and the fair value of the hedge if available. A natural hedge is identified when a firm states in the filings that it uses long-term contracts with either supplier or consumers to fix the price for at least one year[29]. Pass-throughs are not considered to be natural hedges unless there is a written contract of passing most of the input price increase to the customers. I exclude pass-through as an effective hedge because large increases in the input price are hard to pass-through to

[27] I discuss the potential survival bias by restricting firms with five years data in section IV. Generally, including only firms who survive for three years after a shock underestimates the results of predation because the exiting firms are more likely to be the target of predation and those firms tend to be financially constrained and unhedged.
[28] I classify hedges into interest rate hedge, exchange rate hedge and commodity hedge.
[29] Firms can also match input and output currency as a natural hedge for exchange rate risk.

customers if there is competition in the industry. Refer to Appendix A for more details on hedging data.

Other data sources are as following. Firm characteristics are from Compustat. Stock return data are from CRSP. Cotton prices are from the National Cotton Council of America. Lumber prices are from Random Length, a wood industry website. Crude oil, natural gas and jet fuel prices are from the Energy Information Administration. Metal price data are from Commodity Research Bureau, which collects data from the American Metal Market.

4.2.2 Measures of financial constraints and hedging

In the main analysis of chapter 4-6, firms are divided into four groups according to their financial constraints and hedging polices: Unconstrained Unhedged firms (*UU*), Unconstrained Hedged firms (*UH*), Constrained Unhedged firms (*CU*) and Constrained Hedged firms (*CH*). A firm is considered to be "Hedged" if the firm's hedge ratio is greater than its industry average or if the firm uses natural hedges during the fiscal year. The *hedge ratio* is the total notional amount of derivatives divided by cost of goods sold (COGS) except for the Airline industry where all firms report notional amount of derivatives as a percentage of anticipated usage of a commodity. Refer to appendix A for details on the hedge ratio and the notional value of hedges.

Since the ex-ante financial constraint is an important variable in the analysis, several measures are adopted. (1) *Leverage ratio* is used to measure firms' ex ante financial constraints in the main analysis because it is the most straightforward measure and it captures the fact that it is difficult and costly for firms with higher leverage to obtain external financing due to

a debt overhang problem. *Leverage* is calculated as book value of the total debt divided by the total assets. Firms are considered to be constrained if they have a leverage ratio above the industry median, where the industry is defined at 3-digit SIC level. (2) The KZ index is another widely used measure for financial constraints. It gives the propensity of being financially constrained using five measurable firm characteristics—cash holdings, leverage, cash flow, dividend payment and Q. *KZ index* is calculated following Lamont, Polk, and Saá-Requejo (2001) excluding the Q measure[30]. I exclude the Q measure from the formula because Q may measure investment opportunities and may bias my results. Firms are considered to be constrained if they have a KZ ratio above the industry median. (3) I also used the GSA index developed by Hadlock and Pierce (2009) using firm size, age and their quadratic forms[31]. Firms are considered to be constrained if they have a GSA index above the industry median. (4) The *debt rating* is also a measure of financial constraints. I consider a firm to be constrained if it has S&P debt rating below CCC or if it doesn't have a debt rating with non-zero debt outstanding. (5) A firm is considered to be constrained if it has pledgeable assets below its industry median, where *pledgeable* is defined as tangible asset minus book value of debt divided by total assets. (6) The WW index[32] is developed by Whited and Wu (2006) using GMM estimation of an investment Euler equation. Firms are considered to be constrained if they have the WW index above the industry median.

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[30] $KZ_{it} = -1.002CF_{it}/A_{it\_1} - 39.368DIV_{it}/A_{it\_1} - 1.315C_{it}/A_{it\_1} + 3.139LEV_{it}$

[31] See Hadlock and Pierce (2009), table 6, column 7,
$GSA_{it} = -0.92SIZE_{it} + 0.06\ SIZE_{it}^2 - 0.071Age_{it} + 0.001Age_{it}^2$

[32] See Whited and Wu (2006), page 543,
$WW_{it} = -0.091CF_{it} - 0.062DIVPOS_{it} + 0.021TLTD_{it} - 0.044LNTA_{it} + 0.102ISG_{it} - 0.035SG_{it}$

The summary statistics of the characteristics of each of the four constrained and hedged groups are reported in Table 4.2. The financial constraint is measured by the leverage ratio. The results on other financial constraints measures are reported in Appendix D1. Consistent with the literature, financially constrained firms tend to be younger, smaller, with less R&D expenses and lower investment. They also have lower measures of profitability and the industry tend to be less concentrated. The hedged firms are bigger, older, have better performance and higher firm value. Among all the groups, the constrained unhedged group contains smallest and youngest firms with the worst performance measures.

4.2.3 Shocks

To study how ex ante hedging policies affect product market competition outcomes, I need exogenous shocks to the price of commodity inputs, which do not coincide with industry or economy boom. The variable *Shock* is defined as follows:

$$Shock_t = \begin{cases} -1 & if\ c_t > C_{75}\ and\ sg_t < SG_{75}\ and\ gdp_t < GDP_{75} \\ 1 & if\ c_t < C_{25}\ and\ sg_t < SG_{75}\ and\ gdp_t < GDP_{75} \\ 0 & Otherwise \end{cases} \quad (4.1)$$

where c_t is the commodity price growth rate[33] at year t; C_{75} is the top 75th percentile of all commodity price growth rates and C_{25} is the 25th percentile of all commodity price growth rates. sg_t is annual industry sales growth rate and SG_{75} is the 75th percentile of all historical

[33] When there are more than one underlying commodities, a commodity price index is developed and the growth rate is calculated for the index. The index is developed assuming all commodity inputs have the same weight in cost components as detailed usage of commodities is not required to report in SEC filings.

industry sales growth rates. gdp_t is the real annual GDP growth rate and GDP_{75} is the 75th percentile of all real GDP growth rates.

The unfavorable/negative shocks are defined as times when the commodity price growth is in the highest quintile, excluding times when either the industry sales growth or the GDP growth is in the top quintile. The conditions ensure that the unfavorable shocks do not coincide with industry or economy peaks so that the shocks have negative effects on firms' cash flow. The conditions also eliminate the cases when the commodity shocks are driven by increased demand. Summary statistics of the shocks are reported in Table 4.1b. During negative shocks, the average commodity prices increase by 25.1%, the industry sales increase by -0.7% and the GDP growth is 2.5%. By contrast, during normal times, commodity prices increase 7.6% on average, the industry sales growth is 7.7% and the GDP growth is 3.2%.

When commodity prices increase (decrease) for consecutive years, only the first shock is counted. When two consecutive shocks go the opposite directions, the stronger one is counted. The time series of selected commodity prices are shown in Figure 1.

4.3 Methodology and results

4.3.1 Basic results

To investigate whether firms' hedging policies affect product market competition, it is natural to use a long term event study after negative shocks. First, the evidence shows that firms compete more aggressively during negative shocks and predatory behavior may occur.

Second, hedging aims to reduce volatility of cash flows. The benefit of hedging should more likely be observed when there is a negative shock on hedgable cash flow. Third, a necessary condition for predation is that the target firm is financially constrained and that it does not have the funds to fight back the competition. The shocks described in the previous section ensure that financially constrained firms who do not hedge ex ante are less likely to obtain external financing while their internal cash flow is capped by increased commodity prices. Hedging can release the ex post financial constraints through two channels. First, hedged firms have better access to external financing. Hedged firms have relatively more stable cash flows, which makes them better candidates for external financing during negative shocks with limited funds available. This external financing channel is valid for any type of hedging as long as the hedging decreases the volatility of cash flows. Second, hedged firms may have higher internal cash flows relative to their competitors if the underlying exposure being hedged has an increased price. This internal fund channel only holds for commodity hedges.

Because hedging policy may affect ex post financial constraints through the two channels argued above, firms with different ex ante hedging policies and financial constraints may have different product market competition outcomes during and after the negative shocks. The product market competition outcomes are measured by cumulative market share growth and cumulative ROA relative to its industry median, where market share is calculated as sales divided by the total sales of the three-digit-SIC industries. The results of the long term event study are reported in Table 4.3 and Figure 2-4.

As shown in Table 4.3 and Figure 3, after the negative commodity price shocks, financially constrained firms who do not hedge ex ante (group CU) lose 2% of their market share, and this loss of market share persists over the next three years. The unhedged constrained firms also experience 2.4% ROA decrease relative to their industry three years after negative shocks. On the contrary, unconstrained hedged (UH) firms gain market share of 10% and ROA of 2% relative to their industry.

If the effects of commodity price shocks on firms with different hedging polices in the product market are symmetric, it is expected to observe that after positive commodity price shocks[34], constrained hedged firms would experience loss in market share and profitability. However, as shown in Figure 4, after the positive commodity price shocks, financially constrained firms who hedge ex ante (group CH) do not lose significant portion of their market share or their return of assets. One possible explanation is that many firms use option type of derivative contracts as hedging instruments. That type of contracts give firms upside protection without losing the downside profitability when commodity input prices decrease.

4.3.2 Difference-in-difference analysis

The basic results could either be due to the predatory behaviors of the competitors or just because the constrained unhedged firms are poor performance firms who just continue to perform poorly after the shocks.

[34] Positive commodity price shocks mean that the commodity input prices decreases.

In order to distinguish whether the loss of market share growth and ROA for constrained unhedged firms is purely due to the performance trend, I conduct difference-in-difference analysis in this section.

Specifically, instead of examining the cumulative effect from time 0 to 2, I look at the difference between the cumulative effects of three years after the shocks and the cumulative effects of two years before the shocks. And then I compare the difference between different firm groups. The difference-in-difference results are reported in Table 4.4. The results do not change much from the basic analysis.

In order to control for other firm characteristics, I conduct an OLS regression of the difference-in-difference variables. It is important to know what characteristics determine firms' hedging polices and to include characteristics that might affect firm's responses to shocks into the regressions of difference-in-difference variables. The following models are estimated and the results are reported in Table 4.5.

$$P(Y_{it=1} = 1|X_{i\,t-1}, E_{i\,t-1}) = \Phi(X'_{it-1}\beta + E'_{it-1}\gamma) \quad (4.2)$$

Where Y_{it} is dummy hedged in model (1) and dummy of commodity hedge in model (2) shown in Table 4.5. $X_{i\,t-1}$ is a vector of variables that determines hedge and might affect the ex post difference-in-difference measures. Variables included in vector $X_{i\,t-1}$: *log(size)* is the log of market capitalization at the end of each year; *long term debt* is the book value of long term debt scaled by total assets; i*nvestment* is the capital expenditure divided by total assets; *ROA* is the operating income divided by the total assets; *dividends* is the total dividends

divided by total assets; *Cash holdings* are the cash and cash equivalent investments divided by the total assets; *R&D* is R&D expenses scaled by sales; *Q* is the market value of equity plus book value of debt divided by the total assets; *Herfindahl* is the sum of squared market share of the top 50 firms in 3-digit-SIC industry. $E_{i\,t-1}$ is a vector of variables that determine hedges but can be reasonably argued not to affect the ex post difference-in-difference measures. Those exogenous variables will be used as instruments in section III.D. Variables included in vector $E_{i\,t-1}$: *Young_CEO* is an indicator variable of CEO's age less than 45; *Stock compensation percentage* is the total value of executives' stock compensation divided by total compensation; *options compensation percentage* is the total value of executives' options compensation divided by total compensation.

As shown in Table 4.5, columns (1) and (2), determinants for any hedge and commodity hedge are different. The probability of firms having any types of hedges increases with the firm size and the stock compensation ratio; it decreases with the investment, the Herfindahl and the young CEO indicator. By contrast, the probability of firms hedging commodity exposure increases with size, investment and cash holdings; it decreases with R&D expenses and the Q measure.

With vector $X_{i\,t-1}$ as control variables, I regress the difference-in-difference market share growth and the relative ROA on group dummies—UH, CU and CH and interactions of the dummy CU and measures of industry competition. The results are shown in Table 4.6. Constrained unhedged (CU) firms have a negative difference-in-difference market share

growth and relative ROA controlling for firm characteristics. The results are stronger in more concentrated industries and industries with higher range of leverage.

4.3.3 Whole sample with shock indicators

Another way to control for possible performance trends is to model the market share growth and the relative ROA use the whole sample and to estimate interaction effect of group dummies and shock indicators. If the coefficients on the interaction terms are significant, it means that constrained unhedged firms affect market share growth and ROA more during and after the shocks than the potential performance trend.

The results are shown in Table 4.7. The dependent variables are market share growth at time t in column (1), cumulative market share growth for t and t+1 in column (2), cumulative market share growth for t to t+2 in columns (3)-(5), and cumulative relative ROA for t to t+2 in columns (6)-(7). The results show that constrained unhedged (CU) firms experience a negative trend of market share growth, but during and after negative shocks, they lose more in terms of market share and relative ROA. Furthermore, constrained unhedged (CU) firms lose more market share in concentrated industries and industries with higher leverage dispersion.

4.3.3 Treatment effect model with instruments

The previous two subsections control for the potential performance trends. However, endogeneity is still a concern if unobserved firm characteristics affect both whether firms hedge commodity exposure and how firms respond to a negative shock. To mitigate the potential endogeneity, I use variables that affect firms' hedging polices and financial constraints, but that can be reasonably argued not to affect how firms respond to shocks.

The instruments are *LTLCF*, *Young_CEO, Stock compensation ratio* and *options compensation ratio*, where *LTLCF* is the log of 1 plus Tax Loss Carry Forward, which measures the convexity of firms' tax function. The argument is that the more convex the firm's tax function is, the more likely the firm is to hedge. *Young_CEO* is the dummy variable that equals to one when the age of CEO at time *t* is less than 45. Young CEO are less likely to hedge because they are relatively risk averse. *Stock compensation ratio* is value of stock compensation divided by total compensation. *Option Compensation ratio* is the value of options compensation divided by total compensation. Executives with higher stock compensation prefer stable stock prices; therefore they are more likely to hedge. On the contrary, executives with higher option compensation like volatility, so they are less likely to hedge. In the first stage, I adopt a Multinomial Logit model and use the instruments and regular controls to predict probabilities of different outcomes for a group variable, which has outcomes of UU, UH, CU and CH. The first stage results are reported in Table 4.5, column (3)-(5) with UU as the base outcome. The predicted probabilities of different outcomes are assigned to each firm and each firm is assigned to different groups (UU, UH, CU and CH)

according to the highest probability of outcomes. The predicted variables of UU, UH, CU and CH are then used in the second stage regressions. The results at the first stage is consistent with Tufano (1997) and Haushalter (2000)

The results of the second stage regressions are reported in Table 4.8. Columns (1)-(3) report regressions of difference-in-difference market share growth and ROA for t to t+2 and columns (4)-(7) report regressions of market share growth and ROA for the whole sample with interactions of negative shocks indicators. In both models, results are similar to the basic results.

4.4 Conclusions

This chapter studies the relationship between corporate hedging and product market competition and focuses on how firms with different hedging policies respond to unfavorable commodity shocks in the product market competition. Specifically, this chapter uses a broad sample of commodity-inputs industries to investigate whether a commodity shock has a long term effect on unhedged firms.

Using a panel data of 579 firms (6276 observations) over the period of 1994-2008, I find evidence that firms' hedging policies affect product market competition outcomes. Specifically, I find that unhedged firms lose market share and profitability after negative commodity shocks. These effects are persistent for up to five years after the shock. I also find that when I condition the results on firms' ex ante financial constraints, unhedged and constrained firms lose the most of their market share and profitability. The effects are

stronger in concentrated industries and industries with higher leverage dispersion. I adopt a difference-in-difference approach and shock indicators to control for the performance trends and use an instrumental variable methodology to address the potential endogeneity of hedging policies and financial constraints.

Chapter 5
Corporate Risk Management and Product Market Competition

5.1 Introduction

Chapter 4 studies the relationship between corporate hedging and product market competition and focuses on how firms with different hedging policies respond to unfavorable commodity shocks in the product market competition. Specifically, I find that unhedged firms lose market share and profitability after negative commodity shocks. These effects are persistent for up to five years after the shock. I also find that when I condition the results on firms' ex ante financial constraints, unhedged and constrained firms lose the most of their market share and profitability.

The observed market share loss of constrained unhedged firms following negative shocks can be explained by three hypotheses[35]. First, the market share loss of constrained unhedged firms is due to the firm's own decision. Constrained unhedged firms may choose to cut back sales or advertising in the short term and intend to regain the market share and profitability in the longer term. This hypothesis is rejected because the evidence in the paper shows that constrained unhedged firms do not gain back market share and profitability up to five years after the shocks. Second, the market share loss of constrained unhedged firms can be consumer driven. Consumers choose to leave constrained unhedged firms because they

[35] See Opler and Titman (1994)

worry about the product quality or the continuation of future services. Third, the market share loss of constrained unhedged firms can be competitor driven. Competitors with financial advantages have the incentives to compete more aggressively to gain more market share or to drive the unhedged firms out of the market.[36]

In this chapter, I investigate to what extent the loss of market share of constrained unhedged firms is driven by their competitors or their consumers. If the loss of market share of constrained unhedged firms is driven by their consumers, constrained unhedged firms should lose more market share if they have higher product differentiation. I find weak evidence that the market share loss of constrained unhedged firms is stronger in industries with higher product differentiation. If the market share loss of constrained unhedged firms is competitor driven, it should be observed that competitors with financial advantages compete more aggressively during the negative commodity price shocks and gain market in the long term. The results in this chapter show that the market share loss of constrained unhedged firms is stronger in concentrated industries and industries with higher leverage dispersion. It also shows that firms with financial advantages—unconstrained hedged firms—tend to increase advertising expenditures and decrease price-cost-margins during negative commodity shocks, indicating that the negative effects that constrained unhedged firms experience are due to increased competition in the product market.

[36] Based on theories of predation, see Bolton and Scharfstein (1990), John McGee (1958), Lester Telser (1966), Jean-Pierre Benoit (1984), and Jean Tirole (1988)

The rest of the chapter is organized as follows. Section 5.2 describes the data used in this chapter. Section 5.3 describes the methodologies and presents the results. Section 5.4 concludes the chapter.

5.2 Data

The sample consists of manufacturing and the airline industries which have hedgeable commodities as significant inputs components. Chapter 4.2 describes the data in detail. The list of two-digit-SIC industries is reported in Table 4.1.

The final sample covers the period of 1994-2008 and consists of 579 firms, 31 three-digit-SIC industries and 6276 firm-year observations. I compare the characteristics of the final sample used in this paper, of all manufacturing firms and of all Compustat firms. The summary statistics of different samples are reported in Appendix B.

Hedging data are hand collected with keyword searching in 10-K forms from SEC EDGAR. Refer to Appendix A for more details on hedging data.

Other data sources are as following. Firm characteristics are from Compustat. Stock return data are from CRSP. Cotton prices are from the National Cotton Council of America. Lumber prices are from Random Length, a wood industry website. Crude oil, natural gas and jet fuel prices are from the Energy Information Administration. Metal price data are from Commodity Research Bureau, which collects data from the American Metal Market.

In the main analysis of chapter 4-6, firms are divided into four groups according to their financial constraints and hedging polices: Unconstrained Unhedged firms (*UU*), Unconstrained Hedged firms (*UH*), Constrained Unhedged firms (*CU*) and Constrained Hedged firms (*CH*). A firm is considered to be "Hedged" if the firm's hedge ratio is greater than its industry average or if the firm uses natural hedges during the fiscal year. The *hedge ratio* is the total notional amount of derivatives divided by cost of goods sold (COGS) except for the Airline industry where all firms report notional amount of derivatives as a percentage of anticipated usage of a commodity. Refer to appendix A for details on the hedge ratio and the notional value of hedges. The summary statistics of the characteristics of each of the four constrained and hedged groups are reported in Table 4.2. The financial constraint is measured by the leverage ratio. Consistent with the literature, financially constrained firms tend to be younger, smaller, with less R&D expenses and lower investment. They also have lower measures of profitability and the industry tend to be less concentrated. The hedged firms are bigger, older, have better performance and higher firm value. Among all the groups, the constrained unhedged group contains smallest and youngest firms with the worst performance measures.

The unfavorable/negative shocks are defined as times when the commodity price growth is in the highest quintile, excluding times when either the industry sales growth or the GDP growth is in the top quintile. The conditions ensure that the unfavorable shocks do not coincide with industry or economy peaks so that the shocks have negative effects on firms' cash flow. The conditions also eliminate the cases when the commodity shocks are

driven by increased demand. Summary statistics of the shocks are reported in Table 4.1b. The time series of selected commodity prices are shown in Figure 1.

5.3 Methodology and Results

As Opler and Titman (1994) point out, financially distressed firms lose market share during industry downturns. The loss of market share can be manager-induced, customer-induced or competitor-induced. If the loss is due to manager adjusting output level temporarily in response to the increased costs, we don't expect to see loss in the profitability or the effect of market share loss shouldn't be persistent. So, the loss of market share for constrained unhedged firms is not driven by managers. If the loss is because customers abandon financially distressed firms, we expect to see that the loss of market share is more significant for firms with more unique products. If the loss is competitor-induced, we should see that the effect is more significant in concentrated industries and firms that compete more aggressively should gain more market share.

5.3.1 Competition

As shown in previous tests, constrained unhedged (CU) firms lose market share during and after unfavorable commodity shocks and the loss is more significant in concentrated industries and industries with higher leverage dispersion. But do competitors with financial advantages—unconstrained hedged (UH) firms compete more aggressively by increasing advertising or decreasing prices? In this section, I assess whether different firms have different responses in terms of active competition measures after the shocks.

I use two measures of active competition. One is the advertising growth rate, defined as:

$$Advertising\ growth\ rate = \frac{Adx_t}{Adx_{t-1}} - 1 \tag{5.1}$$

Where Adx_t is the advertising expenses divided by sales at time t. The results are reported in Table 9, columns (1)-(2) and (5)-(6), where column (2) uses $\frac{Adx_{t+1}+Adx_t}{2*Adx_{t-1}} - 1$ as the dependent variable. In columns (1) and (2), t includes only periods with negative shocks. In columns (5) and (6), t includes all time periods. The results show that firms with financial advantages (UH group) tend to increase their advertising expenses at the time of negative shocks and the effect is much stronger in more concentrated industries.

The other active competition measure is the change in the Price-Cost-Margin:

$$PCMC_t = PCM_t - \frac{1}{2}(PCM_{t-1} + PCM_{t-2}) \tag{5.2}$$

Where $PCM_t$is the Price-Cost-Margin defined as $\frac{Sales_t - COGS_t}{Sales_t}$.

The results of regressions of *PCMC* are reported in Table 9 columns (3), (4) and (7). In columns (3) and (4), *t* includes only negative shocks. In column (7), *t* includes all time periods. The results show that firms with financial advantages (UH firms) tend to decrease their PCM at the time of negative shocks. The effects are weakly stronger in more concentrated industries.

The results in this section suggest that firms with relative financial advantages (UH firms) actively increase their competition during negative shocks and gain market share and more profitability in the long term.

5.3.2 Product differentiation

If the loss of market share of constrained unhedged (CU) firms is because customers abandon financially distressed firms, we expect the loss of market share to be more significant for firms with unique products. In this section, I test the hypothesis that the market share loss of CU firms is more significant in industries with more product differentiation, where product differentiation is measured using the following three variables.

The first measure is the R&D expense ratio, as adopted in Opler and Titman (1994). The results are shown in Table 9b, columns (1) and (4). The interaction term of the R&D expense and the CU dummy is not statistically significant in the regression of market share growth. It indicates there is no evidence that the market share loss of constrained unhedged (CU) firms is consumer driven.

The second measure of product differentiation is the Pre-shock PCM difference, defined as:

$$\textit{Pre-shock PCM difference} = \left| \frac{1}{2}\sum_{i=t-2}^{t-1} PCM_i - \frac{1}{2}\sum_{i=t-2}^{t-1} PCM_{IND_i} \right| \quad (5.3)$$

where PCM_{IND_i} is the industry median of the Price-Cost-Margin. The *Pre-shock PCM difference* is a firm level measure. It measures how firm's PCM is different from its industry median ex ante. The higher the measure is, the more different the firm's product is from the

industry. The results are reported in Table 9b, column (2) and (5). The interaction term of *Pre-shock PCM difference* and CU dummy is not significant in the regression of market share growth. It indicates there is no evidence that the market share loss of constrained unhedged (CU) firms is consumer driven.

The third measure is Pre-shock PCM dispersion, defined as:

$$\textit{Pre-shock PCM dispersion} = \frac{1}{2}\sum_{i=t-2}^{t-1} sd(PCM)_i \tag{5.4}$$

Where $sd(PCM)_i$ is the standard deviation of the Price-Cost-Margin in the industry. The *Pre-shock PCM dispersion* is an industry level measure. It measures the dispersion of PCM within an industry. The higher the measure is, the more product differentiation the industry has. The results are shown in Table 9b, columns (3) and (6). The interaction term of *Pre-shock PCM dispersion* and CU dummy is positive and significant, indicating that the market share loss of constrained unhedged (CU) firms could be consumer driven.

The results in this section show that one out of three measures of product differentiation can significantly explain the market share loss of constrained unhedged firms. It suggests that there is weak evidence that the market share loss is customer driven.

5.4 Conclusions

In Chapter 4 I find that unhedged firms lose market share and profitability after negative commodity shocks. These effects are persistent for up to five years after the shock.

I also find that when I condition the results on firms' ex ante financial constraints, unhedged and constrained firms lose the most of their market share and profitability.

The observed market share loss of constrained unhedged firms following negative shocks can be explained by three hypotheses. First, the market share loss of constrained unhedged firms is due to the firm's own decision. This hypothesis is rejected because the evidence in the paper shows that constrained unhedged firms do not gain back market share and profitability up to five years after the shocks. Second, the market share loss of constrained unhedged firms can be consumer driven. Consumers choose to leave constrained unhedged firms because they worry about the product quality or the continuation of future services. Third, the market share loss of constrained unhedged firms can be competitor driven. Competitors with financial advantages have the incentives to compete more aggressively to gain more market share or to drive the unhedged firms out of the market.[37]

In this chapter, I investigate to what extent the loss of market share of constrained unhedged firms is driven by their competitors or their consumers. I find weak evidence that the market share loss of constrained unhedged firms is stronger in industries with higher product differentiation. However, I do find evidence supporting the hypothesis that the loss of market share of constrained unhedged firms is driven by their competitors. The results in this chapter show that the market share loss of constrained unhedged firms is stronger in concentrated industries and industries with higher leverage dispersion. It also shows that

[37] Based on theories of predation, see Bolton and Scharfstein (1990), John McGee (1958), Lester Telser (1966), Jean-Pierre Benoit (1984), and Jean Tirole (1988)

firms with financial advantages—unconstrained hedged firms—tend to increase advertising expenditures and decrease price-cost-margins during negative commodity shocks, indicating that the negative effects that constrained unhedged firms experience are due to increased competition in the product market.

Chapter 6
Corporate Risk Management and the "Exiting" Firms

6.1 Introduction

In Chapter 4, I examine how firms with different hedging policies respond to unfavorable commodity shocks in the product market competition. I find that constrained unhedged firms lose market share and profitability for up to five years after negative commodity shocks. When conducting the analysis, I exclude firms with less than three years of data after the shocks because the market share growth ratio suffers survival bias.

In the extreme case of product market competition, financially weak firms are driven out of market. Therefore, if unhedged firms suffer from market share and profitability loss after unfavorable shocks, they should also have high probability of exiting the market as their market share decrease to zero.

In this chapter, I analyze the firms who "exit" the sample during the sample period and what firms and industry characteristics determine the exit. I use the last data year when the firm is in the Compustat database (excluding 2008) as a crude measure of the exit time. I find that constrained unhedged firms are 6% more likely to exit the market than their hedged rivals and the effects are more significant in concentrated industries and industries with higher leverage dispersion. I also find that the effects are significant only for non-merger exit,

which mainly consists of bankruptcy and delisting for non-merger reasons. The results are consistent with the notion that corporate hedging protects firms from bankruptcy and exiting the market.

The rest of the chapter is organized as follows. Section 6.2 describes the data used in this chapter. Section 6.3 describes the methodologies and presents the results. Section 6.4 concludes the chapter.

6.2 Data

The sample consists of manufacturing and the airline industries which have hedgeable commodities as significant inputs components. Chapter 4.2 describes the data in detail. The list of two-digit-SIC industries is reported in Table 4.1.

The final sample covers the period of 1994-2008 and consists of 579 firms, 31 three-digit-SIC industries and 6276 firm-year observations. I compare the characteristics of the final sample used in this paper, of all manufacturing firms and of all Compustat firms. The summary statistics of different samples are reported in Appendix B.

Hedging data are hand collected with keyword searching in 10-K forms from SEC EDGAR. Refer to Appendix A for more details on hedging data.

In the main analysis of chapter 4-6, firms are divided into four groups according to their financial constraints and hedging polices: Unconstrained Unhedged firms (*UU*), Unconstrained Hedged firms (*UH*), Constrained Unhedged firms (*CU*) and Constrained Hedged firms (*CH*). A firm is considered to be "Hedged" if the firm's hedge ratio is greater

than its industry average or if the firm uses natural hedges during the fiscal year. The *hedge ratio* is the total notional amount of derivatives divided by cost of goods sold (COGS) except for the Airline industry where all firms report notional amount of derivatives as a percentage of anticipated usage of a commodity. Refer to appendix A for details on the hedge ratio and the notional value of hedges.

I use the last data year when the firm is in the Compustat database (excluding 2008) as a crude measure of the exit time. The summary statistics for exit and remaining firms are reported in Table 6.1. Compared to surviving firms, the exiting firms are less likely to hedge, tend to be smaller, have a higher leverage and a higher KZ index. This indicates that the firms that exit the sample are more likely to be in the unhedged and financially constrained group. These firms also have a ROA of -5.2% on average and sales growth significantly lower than the surviving firms. The exit firms are more likely to be in an industry with a lower Herfindahl index and lower number of firms. The results show that the firms who disappear tend to be unhedged and distressed. This evidence indicates that they have the worst consequence in product market competition—being driven out of the market.

6.3 Methodology and results

Table 6.2 reports the results of regressions of firms' exit. Columns (1)-(3) report Probit regressions where the dependent variables are dummies of "exit" and the independent variables are the firm and industry characteristics. The marginal effects and the standard

errors of interaction terms are adjusted using Ai and Norton (2003) methods. As shown in Table 6.2, regression (1), constrained unhedged firms (CU) are 6% more likely to exit the market than its unconstrained hedged rivals (UH).

In order to test whether the constrained unhedged firms exiting the market are due to product market competition, I employ the interaction term of measures of industry competition with the group dummy of CU. As shown in Table 6.2, column (2) and (3), constrained unhedged firms (CU) are more likely to exit the market in concentrated industries, measured by higher a Herfindahl ratio, and in industries with higher range of leverage.

Column (4) and (5) in table 6.2 report the results from Cox-Hazard regressions. They show that constrained unhedged (CU) firms have higher hazard rates and the results are stronger in more concentrated industries and in industries with higher range of leverage.

Column (6) and (7) report Multinomial Logit regressions of a dependent variable with outcomes of merger exit, other exit and not exit, where not exit is the base outcome. The results show that constrained unhedged (CU) firms are more likely to exit in other types' of exit, but not as a merger exit.

There are about 24 firms that exit from the sample every year, given the fact that the exiting firms have lower sales growth and market share, higher constraints measures and lower probability to hedge before they exit, my results would be stronger if I can somehow incorporate those disappearing firms in the analysis in chapter 4. Using only the firms that

exist all the time during a five years event window and ignoring the firms exited underestimates the results on predation, but it is a relative conservative method to control the potential survival bias when measuring the market share.

6.4 Conclusions

This paper investigates the relationship between corporate hedging and product market competition. The paper examines how firms with different hedging police respond to unfavorable commodity shocks and whether competition affects firms' hedging polices.

Using a broad sample of 7 industry groups with hedgeable commodities as their significant inputs in 1994-2008, I find evidence that firms' hedging policies affect product market competition and that firms do use hedging policy strategically. Specifically, I find that unhedged firms who are ex ante financially constrained lose market share and experience decreased ROA after negative commodity shocks. The effects are persistent up to five years after the shock and robust to potential trend and endogeneity. I find supportive evidence that competitors with financial advantages increase their advertising expenses and decrease their price-cost-margins during negative shocks. It suggests that the negative effects that unhedged constrained firms experience are due to actively increased competition in the product market. Furthermore, I find that constrained unhedged firms are 6% more likely to exit the market than their unconstrained hedged rivals and that the effects are stronger in highly concentrated industries and industries with higher leverage dispersion. The paper also finds that during the quarter of negative commodity shock, unhedged constrained firms have

significantly negative stock returns. However, I do not find a difference between hedged and unhedged firms during positive commodity shocks, suggesting an asymmetric effect of positive and negative commodity shocks on corporate hedging. In general, firms are more likely to hedge and have a higher hedge ratio in more concentrated industries and high leverage dispersion industries, suggesting that product market competition is an important consideration when firms make their hedging decisions.

In summary, the paper finds evidence that firms use hedging policies strategically in product market competition. Hedging helps firms reduce the predation risk during and after negative shocks. Firms with financial advantages tend to use hedging policies to gain market share from their distressed competitors. Product market competition is an important determinant in firms' hedging policies.

Table 4.1 List of industry groups and summary of hedging policies

The table lists the sample of industry groups at 2-digit SIC level in the paper. *Number of firms* is the average number of firms in 3-digit-SIC industry. *Herfindahl* index is the sum of squared market share in 3-digit-SIC industry. Natural hedge is identified when a firm states in the filings that it uses long-term contracts with either supplier or consumers to fix the price for at least one year. *Hedge ratio* is either firms stated percentage of anticipated commodity usage hedged or the stated notional dollar amount divided by Cost of Goods Sold (COGS). The sample period is 1994-2008.

Industry group	Industry group name	Number of industries	Number of firms per industry	Average Industry Herfindahl	Commodity exposure	Proportion of firms hedged			Average hedge ratio
						Any form of hedge	Commodity hedge only	Natural hedge	
22	Textile Mill Products	4	5.6	0.39	Cotton, Energy	0.60	0.20	0.00	0.16
24	Lumber And Wood Products	3	8.0	0.39	Lumber	0.20	0.05	0.00	0.03
26	Paper And Allied Products	5	23.0	0.26	Lumber, Energy	0.38	0.29	0.00	0.08
29	Petroleum Refining	2	17.1	0.33	Crude Oil and Natural gas	0.67	0.51	0.00	0.12
33	Primary Metal	1	14.8	0.39	Aluminum, Copper, Nickel and Natural Gas	0.46	0.26	0.02	0.33
34	Fabricated Metal Products	6	7.4	0.38	Aluminum, Copper, Zinc and Natural Gas	0.44	0.09	0.06	0.20
37	Transportation Equipment	7	17.9	0.50		0.47	0.09	0.00	0.02
45	Transportation By Air	1	16.6	0.19	Jet Fuel	0.78	0.71	0.26	0.32
Average		3.3	12.9	0.4		0.5	0.2	0.0	0.1
Total		30							

Table 4.2 Summary statistics of commodity price shocks

The table shows the average commodity price growth rate, the industry sales growth rate and the real GDP growth rate during negative shocks, positive shocks and normal times. The unfavorable/negative shocks are times when commodity price growth is in the highest quintile, excluding times when either industry sales growth or GDP growth is in the top quintile. See section II.C for details on the definition of shocks. *Commodity index growth* is the average annual commodity price index growth rate, assuming firms use exposed commodities at equal weight. *Industry sales growth* is the annual industry sales growth in the sample, where industry is defined at three-digit SIC level. The sample period is 1994-2008.

Panel A. Commodity shocks conditional on no economy peak

	Negative shocks	Positive shocks	Normal times
Commodity index growth	0.251	-0.046	0.076
Industry sales growth	-0.007	0.053	0.077
Real GDP growth	0.025	0.030	0.032

Panel B. Commodity shocks only

	Negative shocks	Positive shocks	Normal times
Commodity index growth	0.287	-0.069	0.082
Industry sales growth	0.055	0.057	0.071
Real GDP growth	0.032	0.033	0.031

Table 4.3
Summary statistics of the characteristics of firms grouped by financial constraint and hedging policies

The table shows the mean values of the characteristics of constrained and unconstrained, hedged and unhedged firms. Financial constrained firms are identified as with leverage ratio higher than its industry median. The firm is considered to be "*hedged*" if it uses financial derivative or natural hedge to hedge exposure in commodity or exchange rate during the fiscal year. *Size* is the market value at the end of each year. *Age* is the years since it first appears in CRSP. *R&D expense* is scaled by sales and shown in percentage. *Investment* is the capital expenditure divided by total assets. *Leverage* is the book value of the total debt divided by the total asset. *Long term debt* is the long term debt scaled by the total asset. *Cash holdings* are the cash and cash equivalent investment divided by the total asset. *Current ratio* is current asset divided by current liability. *KZ index* is defined using Lamont, Polk, and Saá-Requejo, (2001) formula. *Operating profit margin* is the gross income divided by total sales. *ROA* is the operating income divided by the total asset. *Q* is the market value of equity plus book value of debt divided by the total assets. *Herfindahl* is the sum of squared market share of the top 50 firms in 3-digit-SIC industry. *Number of firms* is the number of firms in 3-digit-SIC industry. The sample period is 1994-2008. The data is from Compustat. *** indicates 1% significance level, ** indicates 5% significance level and * indicates 10% significance level.

	Constrained firms			Unconstrained firms		
	Hedged	Unhedged	T-stat of difference	Hedged	Unhedged	T-stat of difference
N	1224	1710		1107	2106	
General firm characteristics						
Size (in millions)	3983.5	1938.3	4.80***	8308.3	5917.6	2.35**
Age (years)	23.0	16.0	11.66***	31.6	20.7	17.70***
R&D expense	0.014	0.026	-10.52***	0.016	0.019	-2.34**
Investment	0.063	0.058	2.35**	0.073	0.064	5.17***
Financial condition measures						
Leverage	0.432	0.450	-2.85***	0.202	0.152	11.69***
Long term debt	0.375	0.332	6.11***	0.164	0.118	11.69***
Cash holdings	0.043	0.042	0.59	0.058	0.067	-3.08***
Current Ratio	1.674	1.780	-3.19***	1.772	2.709	-19.59***
KZ Index	1.186	1.354	-5.95***	0.280	0.295	-0.50
KZ Index without Q measure	0.932	1.115	-5.79***	-0.061	-0.033	-0.96
Performance measures						
Operation profit margin	0.119	0.085	10.97***	0.126	0.088	12.62***
ROA	0.084	0.056	8.62***	0.095	0.069	6.48***
Q	1.284	1.183	5.20***	1.424	1.384	1.35
Sales growth	1.151	1.121	3.07***	1.145	1.077	8.35***
Industry competition measures						
Herfindahl index	0.229	0.244	-2.56**	0.246	0.271	-3.27***
Number of firms	26.8	26.8	-0.04	25.9	24.4	1.95*

Table 4.4
Cumulative effects of negative shocks on market share and relative ROA

The table shows the cumulative effects of negative shocks on market share, percentage of market share and profitability measured by relative ROA for constrained and unconstrained, hedged and unhedged firm groups. The table includes only firms existing for all the time between year 0 and year 3 to mitigate the survival bias problem. Financial constrained group are defined using leverage ratio higher its industry median. The firm is considered to be "hedged" if it has hedge ratio greater than industry average. *Market share* is calculated by the sales divided by the total sales of the three-digit-SIC industries. *ROA* is calculated as EBIT divided by total assets adjusted by industry median ROA at the 3-digit-SIC level. *** indicates 1% significance level, ** indicates 5% significance level and * indicates 10% significance level.

	Constrained firms		T-stat of	Unconstrained firms		T-stat of
	Hedged	Unhedged	difference	Hedged	Unhedged	difference
Cumulative market share change						
Year 1	0.000	-0.003	1.975*	0.002	0.001	0.223
Year 2	0.011	-0.004	2.798***	0.006	-0.001	1.601
Year 3	0.011	-0.004	2.766***	0.006	-0.002	1.493
Cumulative percentage market share change						
Year 1	0.005	-0.022	1.548	0.043	0.013	1.203
Year 2	0.029	-0.024	2.688***	0.081	0.020	1.813
Year 3	0.029	-0.022	2.308**	0.106	0.017	1.974**
Cumulative relative ROA change						
Year 1	0.017	-0.001	1.388	0.006	-0.024	0.551
Year 2	0.023	-0.011	2.003**	0.013	-0.023	1.890*
Year 3	0.024	-0.028	2.187**	0.020	-0.017	2.181**

Table 4.5
Summary of Difference-in-difference of market share, ROA and Tobin's Q

The table shows the difference between three years average cumulative effects after the negative shocks and two year average cumulative effects before the shocks. The characteristics include market share, percentage of market share, relative ROA and relative Q for constrained and unconstrained, hedged and unhedged firm groups. The table includes only firms existing for all the time between year -2 and year 3 to mitigate the survival bias problem. Financial constrained group are defined using leverage ratio higher its industry median. The firm is considered to be "hedged" if it has hedge ratio greater than industry average. *Market share* is calculated by the sales divided by the total sales of the three-digit-SIC industries. *Relative ROA* is calculated as EBIT divided by total asset adjusted by industry median. Relative Q is calculated as the ratio of market to book value adjusted by industry median. Industry is defined at the 3-digit-SIC level. *** indicates 1% significance level, ** indicates 5% significance level and * indicates 10% significance level.

Panel A. Difference-in-difference market share change

	Constrained	Unconstrained	T-stat of difference
Hedged	0.011	0.006	1.88*
Unhedged	-0.006	-0.001	-1.50
T-stat of difference	2.84***	2.03**	

Panel B. Difference-in-difference percentage market share change

	Constrained	Unconstrained	T-stat of difference
Hedged	0.037	0.074	-1.93*
Unhedged	-0.020	0.016	-2.15**
T-stat of difference	2.43**	2.80***	

Panel C. Difference-in-difference relative ROA

	Constrained	Unconstrained	T-stat of difference
Hedged	0.003	0.002	1.06
Unhedged	-0.022	-0.003	-1.54
T-stat of difference	2.03**	1.16	

Panel D. Difference-in-difference relative Tobin's Q

	Constrained	Unconstrained	T-stat of difference
Hedged	0.006	0.145	-1.53
Unhedged	-0.141	0.060	-2.23**
T-stat of difference	1.95*	1.42	

Table 4.6 Determinants of hedging

The table shows how the determinants of hedging. Model (1) is Probit regression of hedge dummy, which equals to 1 if firms have any type of outstanding hedge. Model (2) is Probit regression of commodity hedge dummy. Column (3)-(5) report the Multinormial Logit regression, where depend variable take values of UU(Unconstrained and Unhedged), UH(Unconstrained and Hedged), CU(Constrained and Unhedged) and CH(Constrained and Hedged). Base outcome is UU. *Hedged* is 1 when firm's hedge ratio is higher than its industry average. *Constrained* is 1 when firms' leverage is higher than industry median. *Hedge Ratio* is calculated as dollar notional amount of commodity hedge divided by cost of goods sold. LTLCF is the log of 1+Tax Loss Carry Forward. Young_CEO is the dummy variable that equals to one if the age of CEO is under 45. *Stock Compensation ratio* is value of stock compensation divided by total compensation. *Option Compensation ratio* is the value of options compensation divided by total compensation. Other variables are defined in Table 2. All independent variables are measured at t-1. All models include industry and year dummies. The marginal effects and the standard errors of interaction terms are adjusted using Ai and Norton (2003) methods. T-statistics are calculated using heteroskedasticity adjusted standard errors and clustered at the firm level. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)
	Probit of Commodity hedge	Tobit of hedge ratio	Multinormial Logit of UH	Multinormial Logit of CU	Multinormial Logit of CH
Log (size)	0.047	0.117	0.188	-0.459	-0.216
	(2.14)**	(4.87)***	(2.94)***	(-4.51)***	(-2.42)**
Long term debt	0.144	-0.17			
	(0.73)	(-0.74)			
Investment	1.252	1.101	-1.022	-3.574	1.128
	(3.08)***	(2.50)**	(-0.53)	(-1.52)	(0.61)
ROA	-0.57	-1.298	7.011	2.154	5.624
	(-1.62)	(-2.48)**	(3.65)***	(1.10)	(-3.10)***
Dividends	0.003	-17.368	-2.254	-4.191	-19.12
	(0.00)	(-4.50)***	(-0.86)	(-0.22)	(-1.97)**
Cash holding	1.298	0.249	-6.194	-8.020	-5.641
	(3.31)***	(2.59)**	(-4.01)***	(-3.12)**	(-3.43)***
R&D	-5.369	-7.587	-36.913	-12.28	-18.377
	(-2.27)**	(-1.71)*	(-4.77)***	(-1.75)*	(-2.57)**
Q	-0.179	-0.099	-0.288	-0.310	-1.027
	(-2.60)**	(-1.21)	(-1.42)	(-1.18)	(-3.44)***
Herfindahl	-0.307	-0.521	6.254	1.723	5.178
	(-1.40)	(-2.05)**	(8.76)***	(2.03)**	(6.85)***
LTLCF	0.018	0.019	0.067	0.118	0.09
	(2.17)**	(1.95)*	(1.59)	(2.53)**	(2.22)**
Young_CEO	-0.141	-0.069	-0.096	0.980	-0.203
	(-1.70)*	(-1.85)*	(-0.24)	(2.47)**	(-0.43)
Stock compensation ratio	0.111	0.361	0.477	0.742	0.777
	(1.66)*	(1.80)*	(2.47)***	(0.79)	(1.74)*
Option compensation ratio	-0.162	-0.123	-1.005	0.025	-0.988
	(-1.91)*	(-2.10)**	(-2.01)**	(0.04)	(-2.03)***
Constant			0.401	2.469	0.973
			(0.90)	(5.14)***	(2.09)**
observations	3130	3130	3130		
Log pseudolikelihood	-897.83	-69.47	-1115.19		
Pseudo R2	0.22	0.50	0.23		

Table 4.7
OLS regressions of market share growth difference and ROA difference

The table shows OLS regressions of market share growth difference and ROA difference. The dependent variables in Model (1)-(3) are the difference between three years after shocks market share growth and two years before shock market share growth rate. The dependent variables in Model (4)-(6) are the difference between three years after shocks relative ROA and two years before shock relative ROA. UU is dummy of Unconstrained and Unhedged; UH is dummy of Unconstrained and Hedged; CU is dummy of Constrained and Unhedged; CH is dummy of Constrained and Hedged. *Hedged* is 1 when firm's hedge ratio is higher than its industry average. *Constrained* is 1 when firms' leverage is higher than industry median. Other variables are defined in Table 2. All independent variables are measured one year before the identified shocks. T-statistics are calculated using heteroskedasticity adjusted standard errors and clustered at the firm level. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Market share growth	**Market share growth**	**Market share growth**	**Relative ROA**	**Relative ROA**	**Relative ROA**
UH	-0.047	0.066	0.035	0.025	0.024	0.026
	(-0.58)	(0.74)	(0.42)	(0.68)	(0.65)	(0.75)
CH	-0.069	-0.024	0.049	0.036	0.047	0.075
	(-0.85)	(-0.24)	(0.63)	(0.8)	(0.95)	(0.58)
CU	-0.166	-0.131	-0.162	-0.02	-0.019	-0.023
	(-2.01)**	(-2.27)**	(-2.06)**	(-1.86)*	(-1.98)**	(-2.02)**
Log (size)	0.036	0.036	0.034	0.002	0.002	0.003
	(2.76)***	(2.75)***	(2.50)**	(1.89)*	(1.89)*	(2.07)**
Long term debt	-0.058	-0.054	-0.034	0.11	0.11	0.098
	(-0.24)	(-0.23)	(-0.14)	(1.33)	(1.32)	(1.17)
Investment	-1.672	-1.685	-1.634	-0.279	-0.274	-0.276
	(-3.22)***	(-3.24)***	(-3.09)***	(-1.97)*	(-1.96)*	(-1.95)*
ROA	-0.468	-0.471	-0.459			
	(-1.57)	(-1.58)	(-1.53)	-	-	-
Dividends	1.016	0.989	1.13	-0.137	-0.13	-0.174
	(1.51)	(1.49)	(1.74)*	(-0.53)	(-0.51)	(-0.67)
Cash holding	0.135	0.124	0.099	0.096	0.098	0.104
	(0.36)	(0.33)	(0.26)	(0.6)	(0.61)	(0.65)
R&D	-0.694	-0.702	-0.633	-0.58	-0.579	-0.592
	(-0.98)	(-0.99)	(-0.92)	(-1.08)	(-1.08)	(-1.11)
Q	0.030	0.029	0.028	0.021	0.021	0.022
	(0.62)	(0.61)	(0.57)	(0.52)	(0.53)	(0.56)
Herfindahl	-0.414	-0.455	-0.500	0.01	0.02	0.022
	(-2.83)***	(-2.91)***	(-2.74)**	(1.74)*	(1.67)*	(1.91)*
Herfindahl*CU		-0.565			-0.134	
		(-2.07)**			(-1.8)*	
Range of leverage			-0.15			-0.005
			(-1.81)*			(2.09)**
Range of leverage*CU			-0.177			-0.152
			(-2.56)**			(1.90)*
Constant	-0.022	-0.016	0.112	-0.048	-0.05	-0.059
	(-0.18)	(-0.13)	(0.53)	(-0.75)	(-0.77)	(-0.89)
observations	452	452	452	452	452	452
Adjusted R2	0.05	0.05	0.05	0.03	0.03	0.04

Table 4.8
OLS regressions of market share growth and ROA with shock indicators

The table shows pooled OLS regressions with shock indicators. The dependent variables in Model (1)-(5) are the cumulative market share growth at time t to t+2. The dependent variables in Model (6)-(7) are cumulative relative ROA at t+2. *Negative shocks* are defined as top 75th percentile of commodity price growth rate excluding top quintile of industry sales growth and real GDP growth. See section II.C for details. UU is dummy of Unconstrained and Unhedged; UH is dummy of Unconstrained and Hedged; CU is dummy of Constrained and Unhedged; CH is dummy of Constrained and Hedged. *Hedged* is 1 when firm's hedge ratio is higher than its industry average. Other variables are defined in Table 2. All independent variables are measured at t-1. Year dummies and industry dummies are included in all models. T-statistics are calculated using heteroskedasticity adjusted standard errors and clustered at the firm level. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Market share growth at t	Market share growth at t+1	Market share growth at t+2	Market share growth at t+2	Market share growth at t+2	Relative ROA at t+2	Relative ROA at t+2
UH	-0.014	0.002	0.070	0.059	0.062	0.028	0.027
	(-1.04)	(0.49)	(2.17)**	(2.11)**	(-2.03)**	(1.84)*	(1.83)*
CH	-0.028	-0.022	-0.037	-0.037	-0.045	-0.001	-0.000
	(-1.73)*	(-0.72)	(-0.79)	(-0.78)	(-0.96)	(-0.04)	(-0.02)
CU	-0.040	-0.066	-0.117	-0.230	-0.230	-0.043	-0.043
	(-2.37)**	(-1.73)*	(-2.06)**	(-2.88)***	(-2.85)***	(-2.63)**	(-2.63)**
Negative shock	0.032	0.082	0.103	0.101	0.097	-0.009	-0.009
	(2.10)**	(3.12)**	(2.42)**	(2.37)**	(2.29)**	(-0.76)	(-0.78)
Negative shock*UH	0.030	-0.019	0.053	0.053	0.048	0.026	0.026
	(1.14)	(-0.47)	(1.86)*	(1.86)*	(1.79)*	(1.41)	(1.41)
Negative shock*CH	0.017	-0.073	-0.107	-0.105	-0.101	0.041	0.041
	(0.57)	(-1.62)	(-1.65)	(-1.63)	(-1.58)	(1.98)**	(1.99)**
Negative shock*CU	-0.023	-0.099	-0.126	-0.137	-0.138	-0.042	-0.079
	(-1.90)*	(-2.14)**	(-2.68)***	(-1.45)	(-1.44)	(-1.85)*	(-2.10)**
Log (size)	0.000	-0.01	-0.023	-0.023	-0.023	0.01	0.01
	(0.05)	(-1.83)*	(-2.43)**	(-2.44)**	(-2.46)**	(3.29)**	(3.30)***
Long term debt	0.105	0.12	0.139	0.144	0.149	0.039	0.039
	(3.11)***	(1.70)*	(1.14)	(1.18)	(1.22)	(0.89)	(0.90)
Investment	0.114	0.248	0.232	0.245	0.224	-0.189	-0.19
	(1.25)	(1.23)	(0.78)	(0.82)	(0.75)	(-2.00)**	(-2.00)**
ROA	0.043	0.123	0.019	0.023	0.021	1.573	1.575
	(0.71)	(0.93)	(0.09)	(0.10)	(0.09)	(13.03)**	(13.01)**
Dividends	-0.501	-0.623	-0.591	-0.612	-0.628	-0.216	-0.229
	(-3.68)***	(-2.29)**	(-0.96)	(-1.02)	(-1.05)	(-0.90)	(-0.95)
Cash holding	0.184	0.357	0.405	0.406	0.417	-0.110	-0.109
	(2.09)**	(2.65)**	(2.04)**	(2.03)**	(2.09)**	(-1.21)	(-1.20)
R&D	0.657	1.591	1.119	1.097	1.136	-0.034	-0.036
	(2.54)**	(3.20)***	(1.39)	(1.37)	(1.41)	(-0.13)	(-0.13)
Q	0.023	0.029	0.048	0.047	0.048	-0.001	-0.002
	(2.72)***	(2.06)**	(2.06)**	(1.99)**	(2.02)**	(-0.12)	(-0.14)
Herfindahl	-0.047	-0.075	-0.124	-0.147	-0.207	-0.042	-0.045
	(-2.07)**	(-2.14)**	(-2.29)**	(-2.00)**	(-2.30)**	(-1.88)*	(-1.94)*
Herfindahl*CU* Negative shock		-0.162		-0.250			-0.457
		(-		(-2.32)**			(-2.33)**
Herfindahl*CU		0.106		0.603			0.006
		(1.16)		(1.68)*			(0.04)
Range of leverage					-0.11		
					(-1.41)		
Range of leverage* CU*					-0.282		
					(-2.35)**		

Table 4.8
OLS regressions of market share growth and ROA with shock indicators, Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Market share growth at t	Market share growth at t+1	Market share growth at t+2	Market share growth at t+2	Market share growth at t+2	Relative ROA at t+2	Relative ROA at t+2
Range of leverage* CU					0.630 (1.70)*		
Constant	0.988 (54.25)**	1.071 (24.00)**	1.212 (14.53)**	1.22 (14.54)**	1.307 (11.46)**	-0.117 (-4.57)***	-0.116 (-4.55)***
observations	6107	5512	4917	4917	4917	4917	4917
Adjusted R2	0.03	0.03	0.03	0.03	0.03	0.40	0.40

Table 4.9 Two stage regressions of market share growth and ROA

The table shows two stage regressions with instruments of *Female_CEO* dummy, *Yound_CEO* dummy, *stock compensation ratio* and *options compensation ratio*. The definitions are in Table 5. The dependent variables in Model (1)-(2) are the difference between three years after shocks market share growth and two years before shock market share growth rate. The dependent variables in Model (3) are the difference between three years after shocks relative ROA and two years before shock relative ROA. The dependent variables in Model (4)-(6) are the cumulative market share growth at time t and t+2. The dependent variable in Model (7) is cumulative relative ROA at t+2. *Negative shocks* are defined as top 75th percentile of commodity price growth rate excluding top quintile of industry sales growth and real GDP growth. See section II.C for details. UU is dummy of Unconstrained and Unhedged; UH is dummy of Unconstrained and Hedged; CU is dummy of Constrained and Unhedged; CH is dummy of Constrained and Hedged. *Hedged* is 1 when firm's hedge ratio is higher than its industry average. Other variables are defined in Table 2. All independent variables are measured at t-1. Year dummies are included in all models. Industry dummies are included in model (4)-(7). T-statistics are calculated using heteroskedasticity adjusted standard errors and clustered at the firm level. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Market share growth difference	Market share growth difference	Relative ROA difference	Market share growth at t	Market share growth at t+2	Market share growth at t+2	Relative ROA at t+2
UH	0.151	0.152	0.001	-0.013	0.041	0.042	0.017
	(2.21)**	(2.22)*	(1.04)	(-0.67)	(1.76)*	(1.80)*	(1.97)**
CH	0.012	0.020	0.005	-0.026	-0.037	-0.036	-0.018
	(0.11)	(0.17)	(1.16)	(-1.09)	(-0.50)	(-0.49)	(-0.75)
CU	-0.099	-0.097	-0.016	-0.023	-0.141	-0.133	-0.025
	(-1.92)*	(-2.09)**	(-2.55)**	(-1.34)	(-2.56)**	(-2.37)**	(-1.81)*
Negative shock				0.023	-0.005	-0.010	-0.010
				(1.30)	(-0.14)	(-0.28)	(-0.82)
Negative shock * UH				0.049	0.309	0.312	0.041
				(1.66)*	(2.84)**	(2.87)**	(1.03)
Negative shock * CH				0.092	0.077	0.081	0.006
				(2.01)**	(1.34)	(1.45)	(0.34)
Negative shock * CU				-0.037	-0.143	-0.024	-0.031
				(-1.18)	(-2.50)**	(-2.18)**	(-1.70)*
Log (size)	0.014	0.015	0.004	-0.002	-0.015	-0.015	-0.006
	(0.52)	(0.56)	(0.67)	(-0.41)	(-1.18)	(-1.15)	(-1.34)
Long term debt	-0.008	-0.018	0.116	0.088	0.074	0.066	0.014
	(-0.03)	(-0.06)	(1.51)	(1.86)*	(0.48)	(0.42)	(0.23)
Investment	-1.178	-1.17	-0.446	0.007	0.411	0.398	-0.162
	(-2.05)**	(-2.03)**	(-1.95)*	(0.06)	(1.18)	(1.15)	(-1.46)
ROA	-1.397	-1.425	-	-0.120	-0.277	-0.306	1.063
	(-3.18)***	(-3.17)***		(-1.07)	(-0.84)	(-0.91)	(6.20)***
Dividends	1.53	1.529	-0.033	-0.483	-1.505	-1.468	0.203
	(4.48)***	(4.46)***	(-0.34)	(-1.47)	(-2.26)**	(-2.22)**	(0.71)
Cash holding	0.507	0.522	0.409	0.139	0.814	0.812	0.104
	(0.65)	(0.67)	(1.76)*	(1.29)	(3.28)***	(3.30)***	(0.89)
R&D	-2.48	-2.817	-0.146	0.112	1.378	0.927	0.828
	(-1.34)	(-1.35)	(-0.24)	(0.35)	(1.67)*	(1.15)	(2.12)**
Q	0.132	0.133	-0.009	0.045	0.073	0.076	0.066
	(2.12)**	(2.13)**	(-0.38)	(3.41)***	(2.44)**	(2.54)**	(5.92)***
Herfindahl	-0.207	-0.219	-0.028	-0.074	-0.283	-0.304	-0.105
	(-2.03)**	(-2.08)**	(-1.68)*	(-2.18)**	(-3.11)***	(-3.38)***	(-2.48)**
Herfindahl*CU * Negative						-0.918	-0.244
						(-2.85)***	(-2.12)**
Herfindahl*CU		-0.386				0.626	0.156
		(-2.67)***				(1.82)*	(1.75)*

Table 4.9 Two stage regressions of market share growth and ROA, continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Market share growth difference	Market share growth difference	Relative ROA difference	Market share growth at t	Market share growth at t+2	Market share growth at t+2	Relative ROA at t+2
Constant	0.051 (0.17)	0.05 (0.17)	-0.013 (-0.2)	0.996 (22.82)**	1.137 (8.81)***	1.142 (8.93)***	-0.05 (-0.97)
observations	317	317	317	3130	3130	3130	3130
Adjusted R2	0.10	0.10	0.05	0.04	0.06	0.07	0.40

Table 5.1 Regressions of competition measures

The table shows pooled OLS regressions of competition measures. Model (1) and (2) are regressions of advertising expense growth rate at t and at t and t+1 respectively, where t is the years of negative shocks only. Model (3) and (4) are regressions of adjusted Price-Cost-Margin at t, where t is the years of negative shocks only. Model (5) and (6) are regressions of advertising expense growth rate at t and at t with the whole sample. Model (7) is regression of adjusted Price-Cost-Margin at t with the whole sample. *Negative shocks* are defined as top 75th percentile of commodity price growth rate excluding top quintile of industry sales growth and real GDP growth. See section II.C for details. UU is dummy of Unconstrained and Unhedged; UH is dummy of Unconstrained and Hedged; CU is dummy of Constrained and Unhedged; CH is dummy of Constrained and Hedged. *Hedged* is 1 when firm's hedge ratio is higher than its industry average. Other variables are defined in Table 2. All independent variables are measured at t-1. Year dummies are included in all models. Industry dummies are included in model (5)-(7). T-statistics are calculated using heteroskedasticity adjusted standard errors and clustered at the firm level. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Advertising expense growth at t	Advertising expense growth at t and t+1	Adjusted Price-Cost-Margin at t	Adjusted Price-Cost-Margin at t	Advertising expense growth at t	Advertising expense growth at t	Adjusted Price-Cost-Margin at t
UH	0.010	0.015	-0.005	-0.001	0.016	0.017	0.062
	(2.16)**	(1.98)**	(-2.80)***	(-1.93)*	(2.25)**	(1.75)*	(1.38)
CH	0.004	0.012	-0.002	-0.002	0.025	0.025	0.06
	(1.25)	(1.71)*	(-1.22)	(-1.21)	(2.89)***	(2.90)**	(1.20)
CU	-0.003	-0.005	-0.001	-0.006	-0.004	-0.004	0.081
	(-1.20)	(-1.25)	(-0.50)	(-0.80)	(-0.49)	(-0.50)	(1.15)
Negative shock					0.015	0.015	0.075
					(1.55)	(1.55)	(1.29)
Negative shock*UH					0.021	0.030	-0.073
					(1.99)**	(2.02)**	(-2.42)**
Negative shock*CH					-0.037	-0.037	-0.055
					(-2.84)***	(-2.83)**	(-1.02)
Negative shock*CU					0.000	0.000	-0.08
					(0.02)	(0.02)	(-1.27)
Log (size)	-0.005	-0.002	0.000	0.000	-0.001	-0.001	-0.003
	(-1.83)*	(-0.81)	(-0.25)	(-0.18)	(-1.35)	(-1.37)	(-0.87)
Long term debt	-0.07	-0.066	0.010	0.011	-0.034	-0.034	0.072
	(-2.35)**	(-2.09)**	(0.65)	(0.72)	(-2.05)**	(-2.08)**	(0.75)
Investment	-0.213	-0.087	-0.220	-0.219	-0.115	-0.115	0.156
	(-1.81)*	(-0.82)	(-4.31)***	(-4.26)***	(-2.27)**	(-2.29)**	(0.63)
ROA	0.042	0.01	0.059	0.06	0.076	0.076	0.381
	(0.89)	(0.19)	(1.21)	(1.23)	(2.95)***	(2.96)***	(0.98)
Dividends	-0.033	0.202	-0.020	-0.026	-0.013	-0.012	0.184
	(-0.42)	(1.03)	(-0.56)	(-0.72)	(-0.09)	(-0.09)	(0.66)
Cash holding	-0.133	-0.069	-0.048	-0.048	-0.050	-0.05	0.724
	(-1.73)*	(-1.02)	(-1.34)	(-1.32)	(-1.59)	(-1.59)	(0.93)
R&D	-0.106	-0.238	0.218	0.219	0.033	0.035	1.045
	(-0.65)	(-1.27)	(2.75)**	(2.73)**	(0.54)	(0.57)	(1.03)
Q	0.007	-0.001	0.002	0.002	0.001	0.001	-0.074
	(1.19)	(-0.11)	(0.29)	(0.31)	(0.28)	(0.27)	(-1.01)
Herfindahl	-0.004	0.009	0.025	0.041	-0.015	-0.018	0.014
	(-0.11)	(0.24)	(2.06)**	(2.07)**	(-1.32)	(-1.05)	(0.44)
Herfindahl*UH				-0.033		-0.001	0.028
				(-2.36)**		(-0.03)	(0.66)

Table 5.1 Regressions of competition measures, continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Advertising expense growth at t	Advertising expense growth at t and t+1	Adjusted Price-Cost-Margin at t	Adjusted Price-Cost-Margin at t	Advertising expense growth at t	Advertising expense growth at t	Adjusted Price-Cost-Margin at t
Herfindahl*UH* Negative shock						0.026	-0.003
						(2.72)***	(-2.10)***
Constant	0.044	0.025	-0.007	-0.01	1.22	0.007	-0.062
	(2.21)**	(1.07)	(-0.77)	(-0.99)	(0.61)	(0.78)	(-0.93)
observations	452	452	450	450	6107	6107	6107
Adjusted R2	0.04	0.03	0.11	0.12	0.02	0.02	0.03

Table 5.2
Regressions of market share growth with product differentiation measures

The table shows pooled OLS regressions of market share growth with interactions of product differentiation measures. Model (1)-(3) are regressions of market share growth rate difference. Model (4)-(6) are regressions of market share growth rate at t and t+1 with the whole sample. Product differentiation measures include: *RD*, which is R&D expense divided by sales; *PCM difference*, which is absolute value of the difference between firms' previous two years Price-Cost-Margin (PCM) and the industry median; *PCM dispersion*, which is the standard deviation of previous two years PCM within industry. (See section IV.B for details.) *Negative shocks* are defined as top 75th percentile of commodity price growth rate excluding top quintile of industry sales growth and real GDP growth. (See section II.C for details.) UU is dummy of Unconstrained and Unhedged; UH is dummy of Unconstrained and Hedged; CU is dummy of Constrained and Unhedged; CH is dummy of Constrained and Hedged. *Hedged* is 1 when firm's hedge ratio is higher than its industry average. Control variables not reported are log size, Long term debt, Investment, ROA, Dividends ratio, cash holdings ratio, R&D expense, Q and Herfindahl. Other variables are defined in Table 2. All independent variables are measured at t-1. Year dummies are included in all models. Industry dummies are included in model (4)-(6). T-statistics are calculated using heteroskedasticity adjusted standard errors and clustered at the firm level. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Market share growth difference	Market share growth difference	Market share growth difference	Market share growth at	Market share growth at t+2	Market share growth at t+2
UH	0.059	0.064	0.054	0.048	0.058	0.056
	(1.67)*	(1.72)*	(1.60)	(1.04)	(1.23)	(1.20)
CH	0.001	0.032	0.095	0.028	0.032	0.027
	(0.01)	(0.36)	(0.99)	(0.49)	(0.56)	(0.47)
CU	-0.139	-0.129	-0.144	-0.05	-0.06	-0.015
	(-2.14)**	(-2.25)**	(-2.38)**	(-1.69)*	(-1.96)*	(-1.20)
Negative shock				0.048	0.063	0.056
				(1.10)	(1.37)	(1.22)
Negative shock*UH				0.020	0.017	0.016
				(1.73)*	(1.87)*	(1.87)*
Negative shock*CH				-0.046	-0.059	-0.047
				(-0.74)	(-0.91)	(-0.73)
Negative shock*CU				-0.134	-0.121	-0.145
				(-1.93)*	(-2.13)**	(-2.79)***
R&D	-0.829	-0.716	-0.761	2.625	2.843	3.026
	(-1.02)	(-1.05)	(-1.03)	(2.97)**	(4.05)**	(4.31)**
RD*CU	1.747			0.964		
	(0.69)			(0.78)		
RD*CU* Negative shocks				-0.376		
				(-0.17)		
PCM difference		-0.169			0.125	
		(-0.49)			(0.57)	
PCM difference* CU		-0.424			0.382	
		(-0.6)			(0.93)	
PCM difference* CU* Negative shocks					0.084	
					(0.14)	
PCM dispersion			0.109			-0.03
			(0.97)			(-1.39)
PCM dispersion*CU			0.328			-0.035
			(2.36)**			(-0.96)

Table 5.2
Regressions of market share growth with product differentiation measures, continued

	(1)	(2)	(3)	(4)	(5)	(6)
	Market share growth difference	Market share growth difference	Market share growth difference	Market share growth at	Market share growth at t+2	Market share growth at t+2
PCM dispersion*CU* Negative shocks						0.153 (3.02)***
Constant	-0.025 (-0.2)	-0.03 (-0.24)	-0.041 (-0.31)	1.116 (15.19)*	1.097 (15.40)***	1.123 (14.43)***
observations	452	452	451	4917	4917	4917
Adjusted R2	0.05	0.05	0.06	0.03	0.03	0.03

Table 6.1
Summary Statistics of firms exiting and the remaining in the sample

The table shows the summary statistics of the characteristics of the firms who exit the sample during 1994-2008 and the remaining firms. Firm is considered to be an "exit" firm if the latest sample year is not 2008. The firm is considered to be "hedge" if it uses financial derivative or long-term contract to hedge exposure in commodity during the fiscal year. The variables are defined the same as in table 2. *Market share* is calculated by the sales divided by the total sales of the three-digit-SIC industries. ***/**/* indicates 1% /5%/10% significance level respectively.

	Exit firms		Remaining Firms		T-stat of the
	Mean	Std. Dev.	Mean	Std. Dev.	difference
N	329		5947		
Hedge Measures					
Any hedge	0.381	0.49	0.493	0.50	-4.06***
Dummy of exchange or commodity hedge	0.274	0.45	0.369	0.48	-3.74***
Dummy of commodity hedge	0.190	0.40	0.233	0.42	-1.90*
Hedge ratio	0.113	0.10	0.186	0.23	-3.64***
General firm characteristics					
Size (in millions)	1758.8	7264.8	4209.4	20762.7	-5.08***
Age (years)	19.31	14.98	20.38	17.05	-1.25
R&D expense	0.028	0.09	0.025	0.06	0.62
investment	0.049	0.05	0.062	0.06	-4.62***
Financial condition measures					
Leverage	0.337	0.24	0.287	0.20	3.80***
cash holdings	0.056	0.08	0.064	0.09	-1.77*
Current Ratio	1.829	1.35	2.177	1.77	-4.47***
KZ Index without Q measure	0.657	1.40	0.313	1.34	4.36***
Performance measures					
operation profit margin	0.051	0.15	0.097	0.11	-5.45***
ROA relative to industry	-0.052	0.15	-0.012	0.13	-4.79***
Q	1.448	1.05	1.494	0.96	-0.78
Relative to Industry sales growth	-0.018	0.28	0.053	0.31	-4.50***
Market share	0.076	0.16	0.093	0.18	-1.90*
Industry competition measures					
Herfindahl	0.256	0.18	0.257	0.19	-0.12
Number of firms	25.480	20.4	27.506	21.1	-1.75*

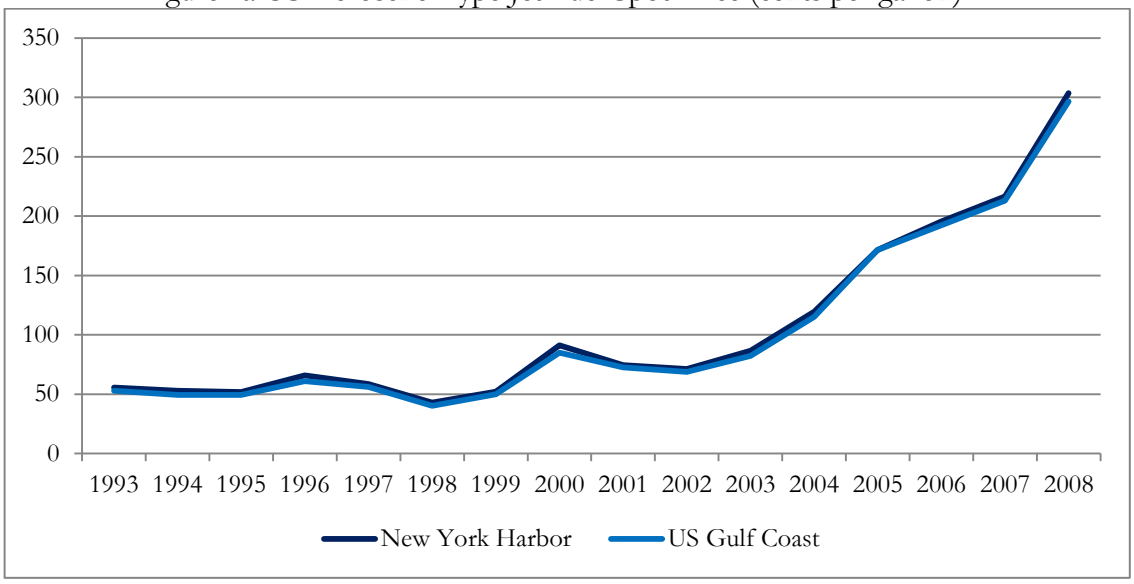
Table 6.2 Probit and Cox-Hazard regressions of firms exiting the sample

The table shows regression of firms who exit the sample. Model (1)-(3) are Probit regressions of firm exit the sample. Model (4)-(5) are Cox-hazard regressions of exit. Model (6)-(7) are Multinomial Logit regressions of a dependent variable with outcomes of merge exit, other exit and not exit, where not exit is the base outcome. A firm is considered to *Exit* if the last year of data is not 2008. The last data year+1 is considered to be the exit year. A firm is considered to be a *Merger Exit* if the first digit of delisting code from CRSP is 2. UU is dummy of Unconstrained and Unhedged; UH is dummy of Unconstrained and Hedged; CU is dummy of Constrained and Unhedged; CH is dummy of Constrained and Hedged. *Hedged* is 1 when firm's hedge ratio is higher than its industry average. Other variables are defined in Table 2. All independent variables are measured at t-1. Year dummies and Industry dummies are included in all models. Marginal effects are reported instead of raw coefficients in model (1)-(3). The marginal effects and the standard errors of interaction terms are adjusted using Ai and Norton (2003) methods. T-statistics are calculated using heteroskedasticity adjusted standard errors and clustered at the firm level. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Probit of Exit	Probit of Exit	Probit of Exit	Cox-Hazard of Exit	Cox-Hazard of Exit	Multinormia l Logit of Merger Exit	Multinormial Logit of other Exits
UH	-0.020	-0.017	-0.016	0.835	0.803	0.027	-0.505
	(-1.19)	(-1.03)	(-0.96)	(-0.74)	(-0.66)	(0.12)	(-1.80)*
CH	0.024	0.022	0.021	1.113	1.103	0.081	0.574
	(1.28)	(1.17)	(1.15)	(0.32)	(0.29)	(0.30)	(1.90)*
CU	0.041	0.025	-0.013	1.543	0.71	0.255	0.701
	(3.44)***	(1.75)*	(-0.38)	(2.44)**	(-0.47)	(0.87)	(2.54)**
Log (size)	-0.013	-0.013	-0.013	0.792	0.788	0.311	-0.218
	(-6.35)***	(-6.40)***	(-6.45)***	(-8.70)***	(-8.79)***	(7.72)***	(-6.76)***
Long term debt	-0.04	-0.040	-0.041	0.531	0.554	-0.319	-1.261
	(-1.32)	(-1.34)	(-1.37)	(-1.34)	(-1.20)	(-0.52)	(-2.52)**
Investment	-0.097	-0.100	-0.105	4.404	4.512	-0.372	-1.424
	(-1.26)	(-1.29)	(-1.35)	(1.13)	(1.14)	(-0.22)	(-1.00)
ROA	-0.067	-0.067	-0.065	0.487	0.474	2.411	-0.807
	(-2.09)**	(-2.09)**	(-2.04)**	(-1.57)	(-1.62)	(1.50)	(-1.62)
Dividends	0.160	0.161	0.153	8.826	8.441	4.185	2.820
	(2.02)**	(2.06)**	(1.92)*	(1.74)*	(1.51)	(2.77)***	(2.04)**
Cash holding	-0.075	-0.076	-0.071	0.125	0.135	4.621	-0.551
	(-1.70)*	(-1.73)*	(-1.62)	(-2.12)**	(-2.05)**	(5.04)***	(-0.64)
R&D	-0.172	-0.178	-0.155	0.032	0.063	4.168	-3.410
	(-1.21)	(-1.24)	(-1.13)	(-1.05)	(-0.91)	(0.57)	(-1.18)
Q	-0.004	-0.004	-0.003	0.969	0.972	-2.827	-0.002
	(-0.73)	(-0.74)	(-0.66)	(-0.36)	(-0.32)	(-5.77)***	(-0.02)
Herfindahl	-0.031	-0.054	-0.083	0.357	0.149	1.455	-0.040
	(-1.39)	(-1.72)*	(-2.17)**	(-2.41)**	(-2.35)**	(3.74)***	(-0.08)
Herfindahl*CU		0.049	0.081		1.959	0.303	0.092
		(2.04)**	(2.46)**		(2.61)**	(0.45)	(2.13)**
Range of leverage			-0.041		0.295		
			(-1.67)		(-2.02)**		
Range of leverage*CU			0.046		2.565		
			(2.17)**		(3.16)***		
Constant						-2.293	-1.611
						(-6.31)***	(-6.23)***
observations	6107	6107	6107	6107	6107	6107	
Log pseudolikelihood	-762.96	-762.39	-761.18	-1612.51	-1609.48	-1448.25	
Pseudo R2	0.07	0.07	0.07			0.10	

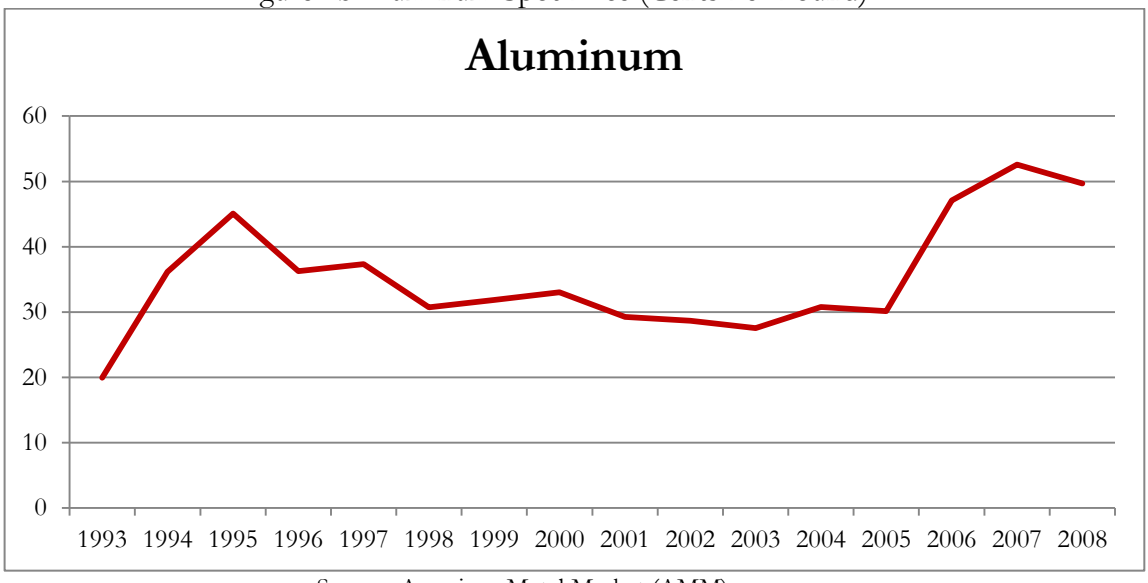
Figure 1 Time Series of Selected Commodity prices

Figure 1a US Kerosene-Type Jet Fuel Spot Price (cents per gallon)



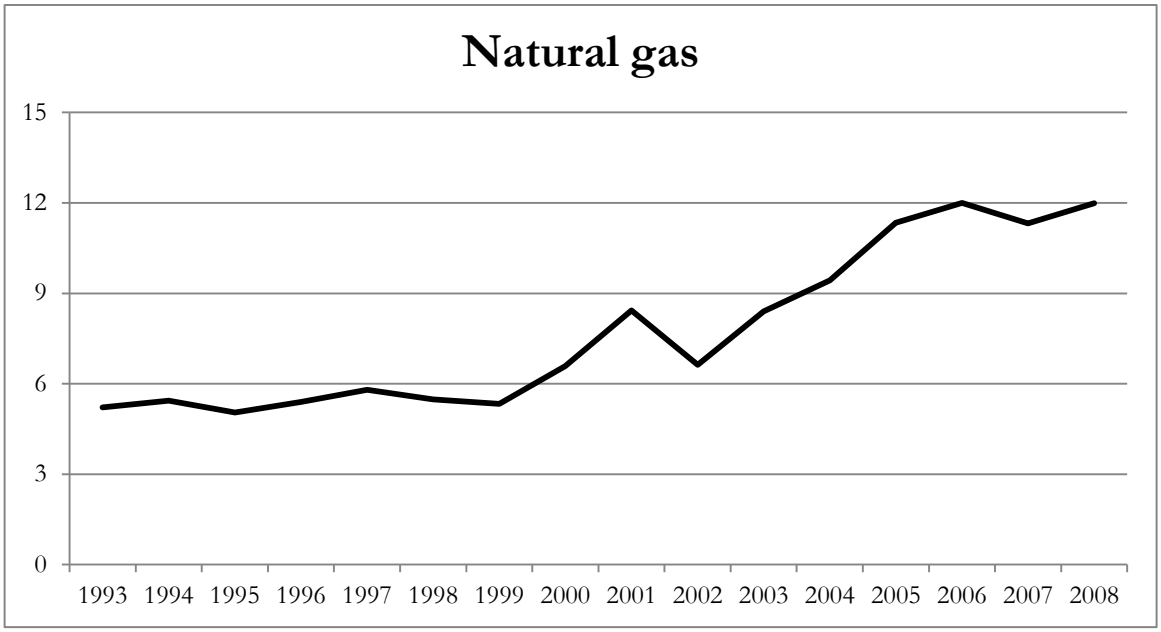
Source: Energy Information Administration

Figure 1b Aluminum Spot Price (Cents Per Pound)



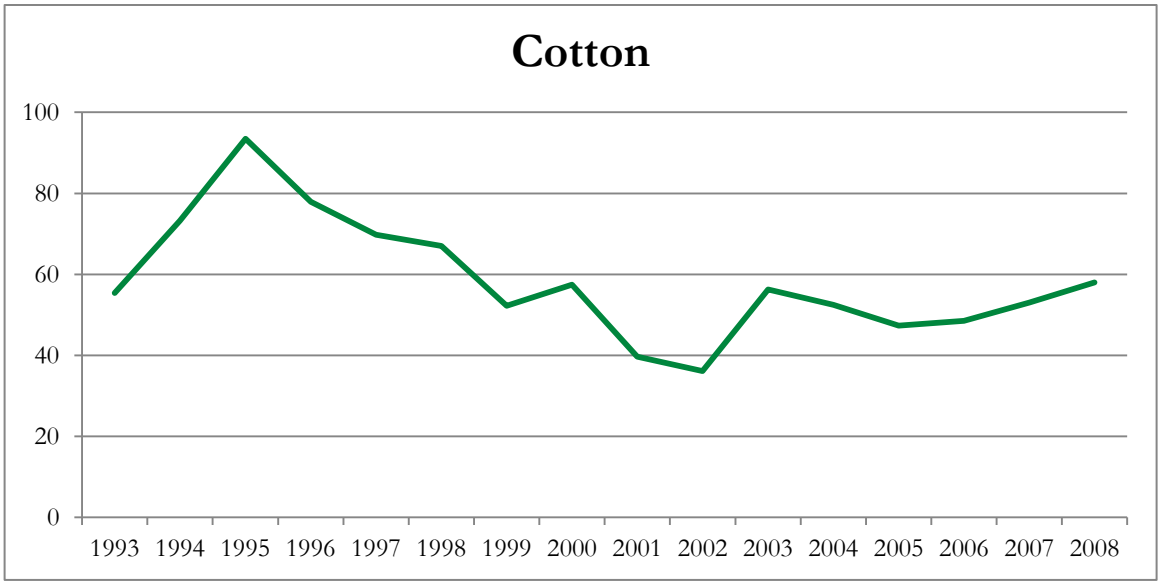
Source: American Metal Market (AMM)

Figure 1c Natural Gas Spot Price (Dollars per Thousand Cubic Feet)



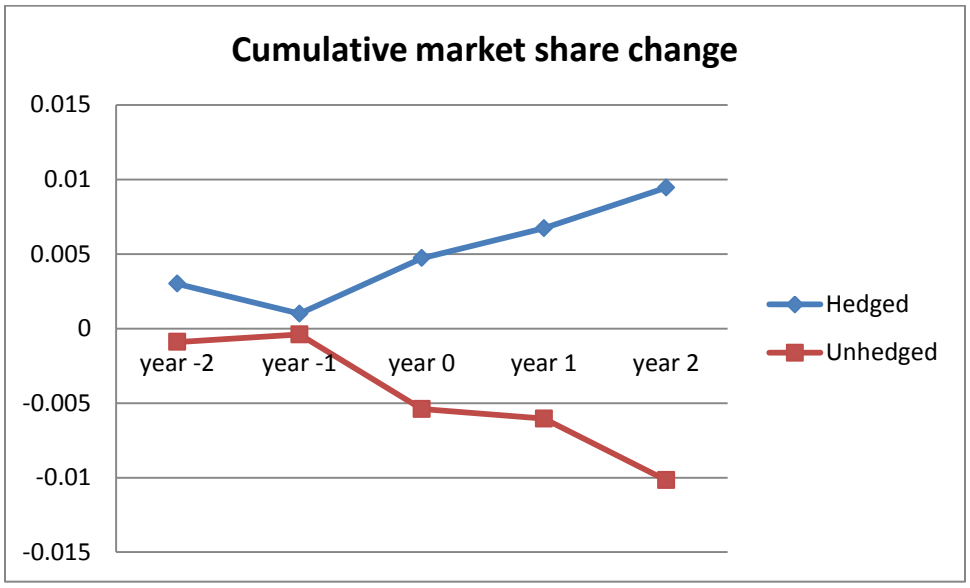
Source: Energy Information Administration

Figure 1d Cotton Spot Price (Cents per pound)



Source: National Cotton Council of America

Figure 2
Cumulative effect of negative shocks on Hedged and Unhedged firms



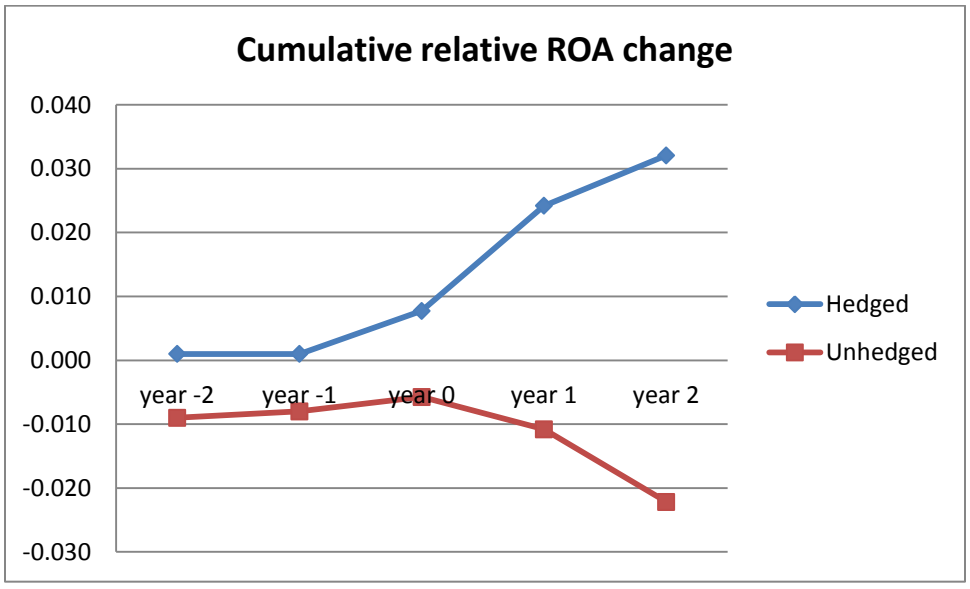


Figure 3
Cumulative effect of negative shocks on market shares and relative ROA

Figure 3a Cumulated Market Share Changes

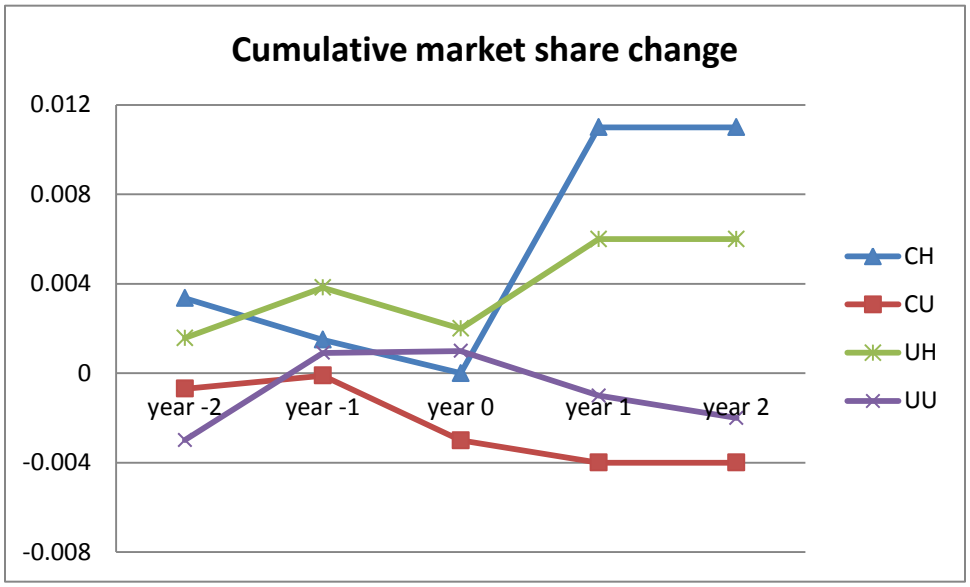


Figure 3b Cumulated Relative ROA Changes

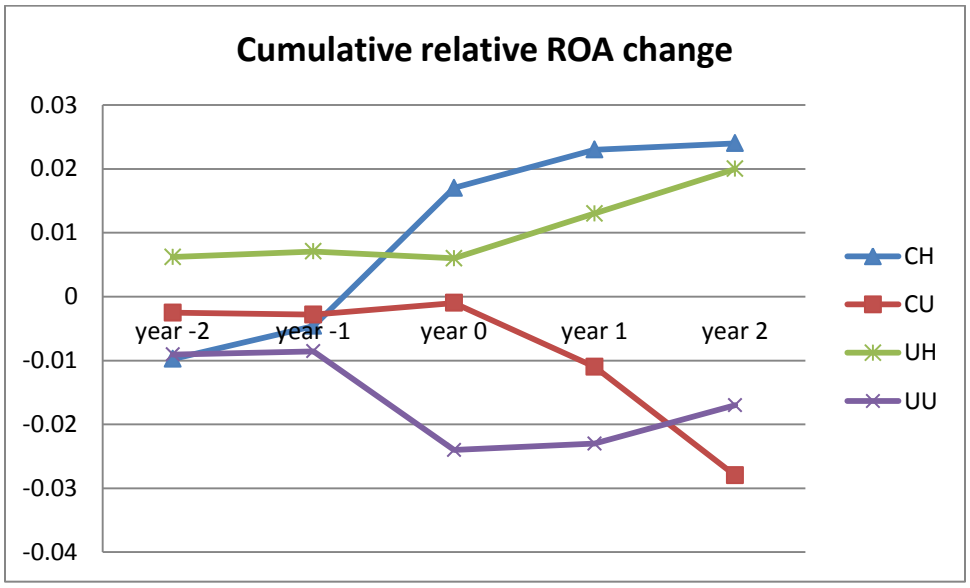


Figure 3c: Cumulated percentage market share growth

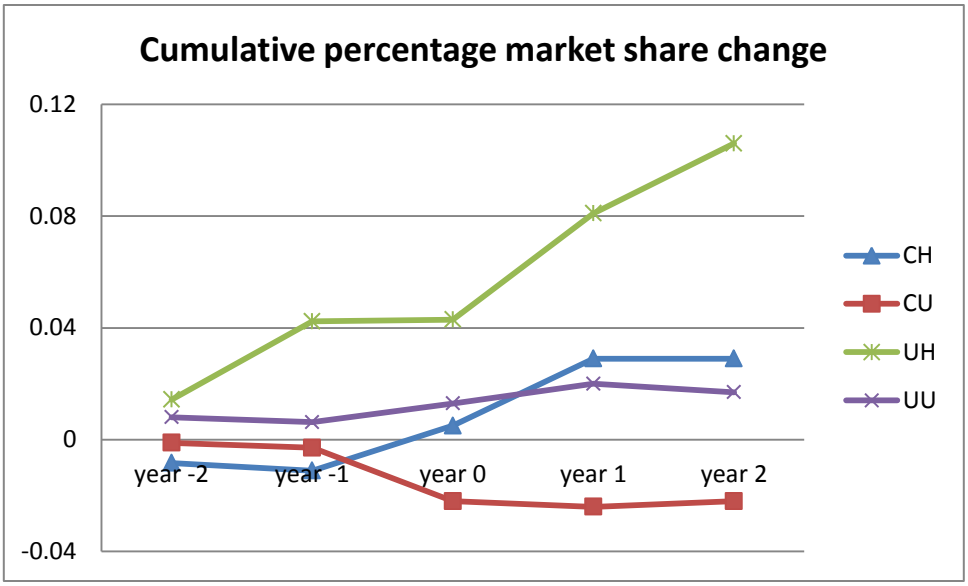


Figure 4
Cumulative effect of positive shocks on market shares and relative ROA

Figure 4a Cumulated Market Share Changes

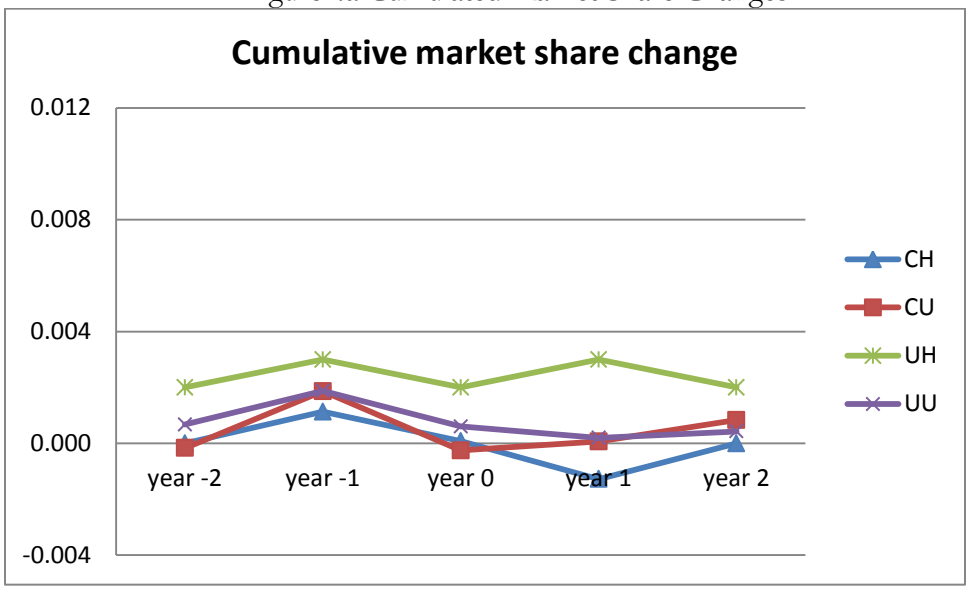


Figure 4b Cumulated Percentage Market Share Changes

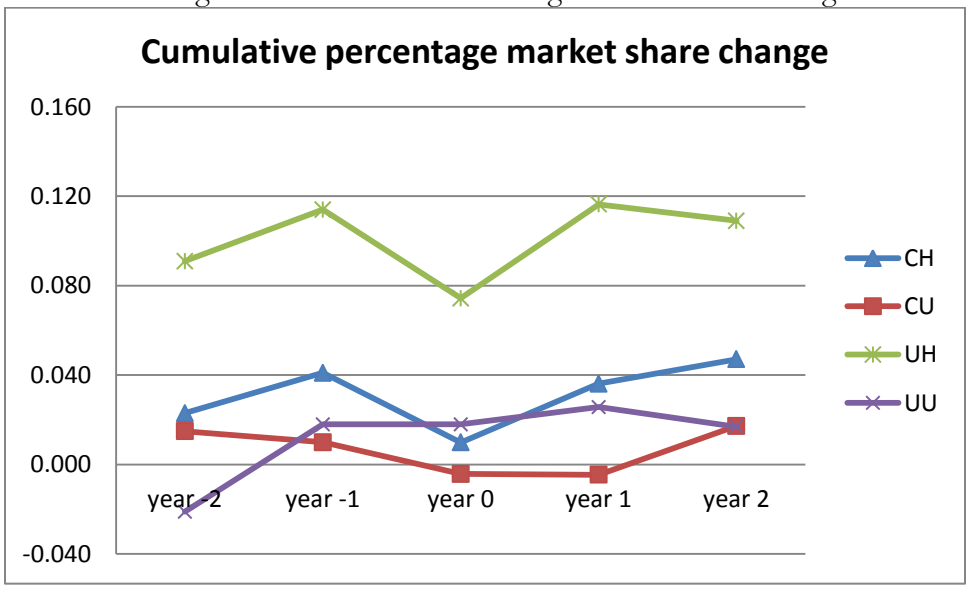
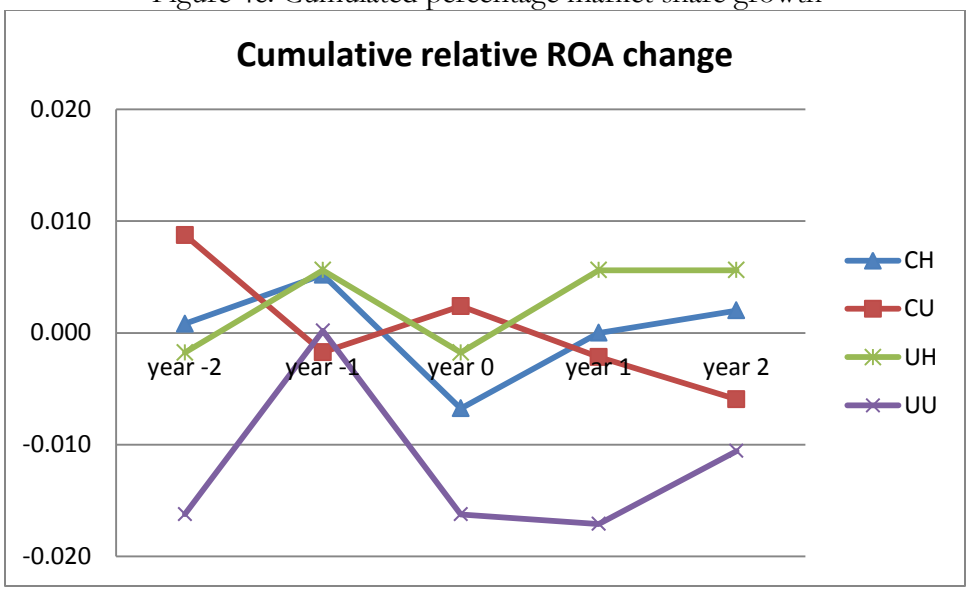


Figure 4c: Cumulated percentage market share growth



Appendix

Appendix A Hedging data details

Firms' hedging data are obtained by keywords searching in SEC 10-K filings. After June 15, 1997, firms are required to report Quantitative and Qualitative Disclosures about Market Risk (Item 7A in 10-K). The rules address risks arising from changes in interest rates, foreign currency exchange rates, commodity prices, equity prices, and other market changes that affect market risk sensitive instruments. Therefore after 1998, for each 10-K, I first read Item 7A (Quantitative and Qualitative Disclosures about Market Risk) and record the following data if available: 1) whether a firm hedges interest rate, foreign exchange rate and/or commodity prices risk. 2) What instruments does the firm use to hedge? 3) What are the notional values of the derivative hedge? 4) What are the fair values of outstanding derivative instruments? 5) What are the gains and losses of the derivative hedges? If hedges are mentioned but no detailed information is disclosed in Item 7A or for years before 1998 when disclosure of market risk is not required, keywords search will be done for the whole text of 10-K. The keywords are searched in the following order: "hedg", "derivative", and "raw material". The keywords search process is ended when all the above information is found or no information is found after all keywords are searched, in which case, the firm is considered to be unhedged.

The hedge ratio is defined as total notional value of hedges divided by this year's Cost of Goods Sold (COGS), except for the Airlines industry, where all firms report notional amount of derivatives as a percentage of anticipated usage of a commodity. For the Airlines

industry, when quarterly hedges are reported, the annual hedge ratio is defined as the average of quarterly hedge ratios. For example, if the company reports "we hedge 44%, 23%, 4% and 1% of its anticipated aircraft fuel consumption for the first, second, third and fourth quarters of 2007", the total notional value for its 2007 hedge is 18% ($= \frac{44\%+23\%+4\%+1\%}{4}$). The same average method is used when the reported notional (fair) value is the dollar value of the contracts in other industries. When firms report notional (fair) value separately for different commodities, for example copper, aluminum and zinc for metal industries, the total value is recorded. When firms report notional (fair) value separately for different contracts, for example forward, collar and options, the total value is recorded. The firm is defined as option hedge user if it uses options, collar or cap contracts. The realized gain or loss is recorded as gain in the current year instead of unrealized gain or loss.

Appendix B Summary statistics of different samples

The table shows the mean, median and standard deviations of firm and industry characteristics of all firms in Compustat, all manufacturing firms and the final sample used in the paper. *Size* is the market value at the end of each year. *Age* is the years since it first appears in CRSP. *R&D expense* is scaled by sales and shown in percentage. *Investment* is the capital expenditure divided by total assets. *Leverage* is the book value of the total debt divided by the total asset. *Cash holdings* are the cash and cash equivalent investment divided by the total asset. *KZ index* is defined using Lamont, Polk, and Saá-Requejo, (2001) formula. *Operating profit margin* is the gross income divided by total sales. *ROA* is the operating income divided by the total asset. *Q* is the market value of equity plus book value of debt divided by the total assets. *Herfindahl* is the sum of squared market share of the top 50 firms in 3-digit-SIC industry. *Number of firms* is the number of firms in 3-digit-SIC industry. The sample period is 1994-2008.

	All Firms in Compustat			All Manufacturing Firms			Firms in Final Sample		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
N	145265			53218			6276		
General firm characteristics									
Size (in millions)	2206.59	129.04	12694.2	2470.59	123.62	12852.6	3799.25	206.40	19126.6
Age (years)	12.40	8.00	12.8	14.31	9.00	14.0	20.26	15.00	16.6
R&D expense	0.093	0.030	0.94	0.110	0.053	0.16	0.026	0.011	0.07
Investment	0.062	0.038	0.08	0.053	0.038	0.05	0.062	0.046	0.06
Financial condition measures									
Leverage	0.246	0.203	0.23	0.230	0.194	0.21	0.292	0.271	0.20
Cash holdings	0.105	0.044	0.15	0.123	0.061	0.16	0.062	0.030	0.08
KZ Index	0.745	0.728	1.03	0.706	0.701	0.99	0.710	0.743	0.95
KZ Index without Q measure	0.286	0.230	1.02	0.238	0.196	1.00	0.412	0.438	0.98
Performance measures									
Operation profit margin	0.135	0.124	0.25	0.068	0.101	0.20	0.094	0.100	0.11
ROA	0.022	0.055	0.18	0.016	0.066	0.21	0.069	0.081	0.12
Q	1.835	1.345	1.38	1.957	1.450	1.46	1.440	1.208	0.88
Sales growth	1.148	1.088	0.35	1.128	1.078	0.34	1.098	1.068	0.26
Industry competition measures									
Herfindahl	0.142	0.100	0.14	0.157	0.108	0.15	0.261	0.233	0.19
Number of firms	186.3	72.0	235.3	116.3	55.0	116.7	26.0	23.0	20.0

Appendix C Related accounting standard

Statements of Financial Accounting Standards No. 133, Accounting for Derivative Instruments and Hedging Activities, commonly known as FAS 133, is an accounting standard issued in June 1998 by the Financial Accounting Standards Board (FASB) that requires companies to measure all assets and liabilities on their balance sheet at "fair value".

FAS133 requires adopted entities comply with the statement by 12/31/2001.

To be designated and qualify for FAS 133 hedge accounting, a commodity (hedged item) and its hedging instrument must have a correlation ratio between 80% and 125%, and the reporting enterprise must have hedge documentation in place at the inception of the hedge.

This Statement establishes accounting and reporting standards for derivative instruments, including certain derivative instruments embedded in other contracts, (collectively referred to as derivatives) and for hedging activities. It requires that an entity recognize all derivatives as either assets or liabilities in the statement of financial position and measure those instruments at fair value. If certain conditions are met, a derivative may be specifically designated as (a) a hedge of the exposure to changes in the fair value of a recognized asset or liability or an unrecognized firm commitment, (b) a hedge of the exposure to variable cash flows of a forecasted transaction, or (c) a hedge of the foreign currency exposure of a net investment in a foreign operation, an unrecognized firm commitment, an available-for-sale security, or a foreign-currency-denominated forecasted transaction.

The accounting for changes in the fair value of a derivative (that is, gains and losses) depends on the intended use of the derivative and the resulting designation.

For a derivative designated as hedging the exposure to changes in the fair value of a recognized asset or liability or a firm commitment (referred to as a fair value hedge), the gain or loss is recognized in earnings in the period of change together with the offsetting loss or gain on the hedged item attributable to the risk being hedged. The effect of that accounting

is to reflect in earnings the extent to which the hedge is not effective in achieving offsetting changes in fair value.

For a derivative designated as hedging the exposure to variable cash flows of a forecasted transaction (referred to as a cash flow hedge), the effective portion of the derivatives gain or loss is initially reported as a component of other comprehensive income (outside earnings) and subsequently reclassified into earnings when the forecasted transaction affects earnings. The ineffective portion of the gain or loss is reported in earnings immediately.

For a derivative designated as hedging the foreign currency exposure of a net investment in a foreign operation, the gain or loss is reported in other comprehensive income (outside earnings) as part of the cumulative translation adjustment. The accounting for a fair value hedge described above applies to a derivative designated as a hedge of the foreign currency exposure of an unrecognized firm commitment or an available-for-sale security. Similarly, the accounting for a cash flow hedge described above applies to a derivative designated as a hedge of the foreign currency exposure of a foreign-currency-denominated forecasted transaction.

For a derivative not designated as a hedging instrument, the gain or loss is recognized in earnings in the period of change.

Appendix D1 Robustness with other measures of financial constraints

The table shows the robustness tests. Panel A shows the regressions of diff-in-diff market share growth using different measures of financial constraints. *KZ index* is defined using Lamont, Polk, and Saá-Requejo, (2001) formula without Q measure. GSA index is calculated as Hadlock and Pierce (2009). *Debt rating* measures a firm to be constrained if he has S&P debt rating below CCC or if he doesn't have a debt rating with non-zero debt outstanding. *Pledgeable* measures a firm is to be constrained if he has pledgeable assets below its industry median, where pledgeable is defined as tangible asset minus book value of debt divided by total assets. WW index is financial constraint index is defined using Whited and Wu (2006). See section II for detailed data definition. T-statistics are calculated using standard errors clustering in firms and adjusted for heterogeneity. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)	(5)
	KZ index	**GSA index**	**Debt Rating**	**Pledgeable asset**	**WW index**
UH	0.055 (1.68)*	-0.014 (-1.18)	0.060 (1.88)*	0.080 (2.07)**	0.031 (1.26)
CH	0.042 (1.45)	0.035 (0.29)	0.036 (1.58)	-0.103 (-0.99)	-0.089 (-1.02)
CU	-0.013 (-1.92)*	-0.014 (-2.15)**	-0.061 (-2.56)**	-0.086 (-2.88)***	-0.128 (-3.35)***
Log (size)	0.038 (2.79)***	0.039 (3.04)***	0.046 (2.74)***	0.037 (2.78)***	0.048 (3.05)***
Long term debt	-0.113 (-0.51)	-0.108 (-0.51)	-0.068 (-0.34)	-0.313 (-1.19)	-0.09 (-0.43)
Investment	-1.673 (-3.23)***	-1.715 (-3.29)***	-1.716 (-3.41)***	-1.62 (-3.06)***	-1.686 (-3.31)***
ROA	-0.483 (-1.61)	-0.489 (-1.65)	-0.504 (-1.69)*	-0.445 (-1.47)	-0.49 (-1.62)
Dividends	0.984 (1.47)	0.975 (1.31)	0.934 (1.40)	1.037 (1.57)	1.135 (1.71)*
Cash holding	0.141 (0.38)	0.074 (0.20)	0.088 (0.22)	0.187 (0.51)	0.084 (0.23)
R&D	-0.681 (-0.96)	-0.706 (-0.98)	-0.691 (-0.94)	-0.75 (-1.01)	-0.713 (-1.03)
Q	0.024 (0.50)	0.023 (0.48)	0.023 (0.46)	0.025 (0.50)	0.018 (0.36)
Herfindahl	-0.413 (-2.64)**	-0.411 (-2.67)***	-0.435 (-2.85)***	-0.406 (-2.64)**	-0.413 (-2.66)**
Herfindahl*CU	-0.239 (-1.79)*	-0.354 (-2.69)***	-0.988 (-3.25)***	-0.14 (-0.37)	-0.160 (-2.41)**
Constant	-0.022 (-0.17)	-0.004 (-0.03)	-0.046 (-0.29)	0.098 (0.72)	0.016 (0.13)
observations	452	452	452	452	452
Adjusted R2	0.05	0.05	0.05	0.05	0.05

Appendix D2
Cumulative effects for 2 years after the shocks, including 2007 shocks

The table shows the cumulative effects and diff-in-diff of negative shocks on market share, percentage of market share and profitability measured by relative ROA for constrained and unconstrained, hedged and unhedged firm groups. The diff-in-diff measures are calculated as cumulative effect over year 1 to 2 minus 2 years cumulative effect before the shock. The table includes only firms existing for all the time between year 0 and year 2 to mitigate the survival bias problem. Financial constrained group are defined using leverage ratio higher its industry median. The firm is considered to be "hedged" if it has hedge ratio greater than industry average. *Market share* is calculated by the sales divided by the total sales of the three-digit-SIC industries. *ROA* is calculated as EBIT divided by total asset adjusted by industry median ROA at the 3-digit-SIC level. *** indicates 1% significance level, ** indicates 5% significance level and * indicates 10% significance level.

	Constrained firms		T-stat of	Unconstrained firms		T-stat of
	Hedged	Unhedged	difference	Hedged	Unhedged	difference
Cumulative market share change						
Year 1	0.005	-0.001	1.94*	0.004	0.002	1.06
Year 2	0.005	-0.002	2.11**	0.005	0.001	1.87*
Diff-in-diff	-0.001	-0.002	1.26	0.006	0.002	1.85*
Cumulative percentage market share change						
Year 1	0.009	-0.010	2.24**	0.065	0.026	1.69*
Year 2	0.029	-0.001	2.08**	0.136	0.017	3.23*
Diff-in-diff	0.035	0.013	1.84*	0.108	0.040	1.73*
Cumulative relative ROA change						
Year 1	-0.007	-0.026	2.34**	0.002	0.003	1.39
Year 2	0.000	-0.032	2.39**	0.011	-0.004	1.78*
Diff-in-diff	0.000	-0.014	1.95*	0.009	-0.013	2.18**

Appendix D3 Cumulative effects for 5 years after the shocks

The table shows the cumulative effects and difference-in-difference of negative shocks on market share, percentage of market share and profitability measured by relative ROA for constrained and unconstrained, hedged and unhedged firm groups. The diff-in-diff measures are calculated as cumulative effect over year 1 to 5 minus 2 years cumulative effect before the shock. The table includes only firms existing for all the time between year 0 and year 5 to mitigate the survival bias problem. Financial constrained group are defined using leverage ratio higher its industry median. The firm is considered to be "hedged" if it has hedge ratio greater than industry average. *Market share* is calculated by the sales divided by the total sales of the three-digit-SIC industries. *ROA* is calculated as EBIT divided by total asset adjusted by industry median ROA at the 3-digit-SIC level. *** indicates 1% significance level, ** indicates 5% significance level and * indicates 10% significance level.

	Constrained firms		T-stat of the difference	Unconstrained firms		T-stat of the difference
	Hedged	Unhedged		Hedged	Unhedged	
Cumulative market share change						
Year 1	0.011	-0.002	1.23	0.002	0.002	0.15
Year 2	0.005	-0.004	1.83*	0.008	0.002	1.19
Year 3	0.003	-0.005	1.67*	0.009	0.001	1.78*
Year 4	0.001	-0.008	1.76*	0.009	0.000	1.89*
Year 5	0.002	-0.006	1.81*	0.006	-0.002	2.23**
Diff-in-diff	0.001	-0.004	1.91*	0.005	-0.001	2.03**
Cumulative percentage market share change						
Year 1	-0.014	-0.047	1.43	0.072	0.027	1.39
Year 2	-0.010	-0.062	1.41	0.139	0.047	1.54
Year 3	-0.018	-0.033	1.34	0.182	0.037	2.35**
Year 4	-0.014	-0.047	1.94	0.259	0.015	3.25***
Year 5	-0.005	-0.061	2.25**	0.296	-0.023	3.86***
Diff-in-diff	0.002	-0.021	2.98***	0.254	-0.011	3.14***
Cumulative relative ROA change						
Year 1	-0.002	-0.044	1.70*	0.007	0.013	-0.377
Year 2	-0.005	-0.069	1.96*	0.021	0.016	0.843
Year 3	-0.004	-0.080	2.38**	0.028	0.005	1.957*
Year 4	-0.011	-0.119	2.50**	0.039	0.015	2.002**
Year 5	-0.018	-0.157	2.68***	0.041	0.034	1.812*
Diff-in-diff	-0.019	-0.141	2.71***	0.036	0.030	1.109

Appendix E Main results for different industries

The table shows the pooled OLS regressions with shock indicators. The dependent variables are the cumulative market share growth from time t to t+2. Columns (1) and (2) show results for the Airlines industry; columns (3) and (4) show results for the Metal industries (SIC 3300-3499); columns (5) and (6) show results for the Petroleum industry; columns (7) and (8) show results for the other industries. See section II for detailed data definition. T-statistics are calculated using standard errors clustering in firms and adjusted for heterogeneity.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Airlines	**Airlines**	**Metals**	**Metals**	**Petroleum**	**Petroleum**	**Others**	**Others**
UH	0.072	0.068	-0.125	-0.125	0.004	0.004	0.094	0.093
	(0.67)	(0.64)	(-1.43)	(-1.43)	(0.02)	(0.02)	(1.49)	(1.43)
CH	0.134	0.127	0.033	0.034	-0.244	-0.244	0.74	0.743
	(1.39)	(1.32)	(0.11)	(0.12)	(-1.12)	(-1.12)	(1.35)	(1.35)
CU	-0.04	-0.491	0.009	-0.133	-0.326	-0.392	-0.166	0.007
	(-0.51)	(-0.56)	(0.07)	(-0.9)	(-2.47)	(-1.45)	(-2.53)	(0.06)
Negative shock	0.120	0.125	0.038	0.038	-0.089	-0.089	0.09	0.091
	(1.86)	(1.91)	(0.93)	(0.93)	(-1.91)	(-1.91)	(2.05)	(2.07)
Negative shock*UH	0.132	0.132	0.063	0.065	0.055	0.055	0.235	0.240
	(1.91)	(1.91)	(2.42)	(2.43)	(1.35)	(1.35)	(1.85)	(1.77)
Negative shock*CH	-0.149	-0.150	0.028	0.027	0.379	0.379	-0.948	-0.949
	(-1.33)	(-1.34)	(0.09)	(0.08)	(0.98)	(0.98)	(-1.73)	(-1.73)
Negative shock*CU	-0.236	-1.652	-0.159	-0.018	0.076	0.072	-0.041	-0.195
	(-2.70)	(-1.98)	(-2.02)	(-2.09)	(0.72)	(0.71)	(-1.93)	(-2.03)
Log (size)	-0.014	-0.016	-0.041	-0.041	-0.02	-0.02	-0.019	-0.020
	(-0.98)	(-1.07)	(-1.61)	(-1.62)	(-0.89)	(-0.89)	(-1.92)	(-1.94)
Long term debt	0.124	0.141	-0.261	-0.259	0.955	0.955	0.206	0.207
	(0.56)	(0.62)	(-1.02)	(-1.01)	(2.43)	(2.42)	(1.51)	(1.51)
Investment	0.729	0.708	0.195	0.2	0.068	0.068	-0.161	-0.144
	(2.15)	(2.05)	(0.27)	(0.27)	(0.07)	(0.07)	(-0.32)	(-0.29)
ROA	-1.581	-1.579	0.105	0.115	0.555	0.554	0.329	0.332
	(-2.36)	(-2.33)	(0.24)	(0.21)	(0.60)	(0.60)	(1.55)	(1.55)
Dividends	0.569	0.574	-0.601	-0.604	-4.984	-4.985	-0.66	-0.653
	(1.42)	(1.43)	(-0.35)	(-0.35)	(-1.74)	(-1.73)	(-1.14)	(-1.14)
Cash holding	1.090	1.079	0.862	0.868	-0.038	-0.038	0.236	0.242
	(3.41)	(3.37)	(1.55)	(1.57)	(-0.03)	(-0.03)	(1.17)	(1.20)
R&D			1.877	1.886	-16.177	-16.187	1.45	1.457
			(0.87)	(0.88)	(-0.97)	(-0.97)	(1.83)	(1.83)
Q	0.189	0.191	0.051	0.051	0.191	0.191	0.043	0.043
	(2.47)	(2.48)	(1.16)	(1.15)	(1.49)	(1.48)	(1.64)	(1.65)
Herfindahl	-7.012	-7.797	0.329	0.311	-1.243	-1.244	-0.188	-0.17
	(-1.94)	(-2.21)	(1.36)	(1.25)	(-2.60)	(-2.59)	(-2.02)	(-1.79)
Herfindahl*CU* Negative shock		-0.167		-0.721		0.234		-0.490
		(-2.83)		(-2.92)		(0.73)		(-1.80)
Herfindahl*CU		4.785		0.725		1.078		-0.551
		(0.53)		(0.94)		(0.62)		(-1.68)
Constant	1.44	1.523	1.304	1.309	1.228	1.228	1.147	1.14
	(4.01)	(4.34)	(6.01)	(6.00)	(5.10)	(5.08)	(15.15)	(15.12)
observations	327	327	1456	1456	304	304	1699	1699
Adjusted R2	0.27	0.27	0.03	0.04	0.13	0.13	0.05	0.05

Appendix F Other dimensions of hedging polices

The table shows OLS regressions of market share growth difference and relative ROA difference. The dependent variables in Model (1)-(2) are the difference between three years after shocks market share growth and two years before shock market share growth rate. The dependent variables in Model (3)-(4) are the difference between three years after shocks relative ROA and two years before shock relative ROA. *Option hedge* is dummy of whether firm use option type of derivative to hedge. *Hedge other exposure* is dummy of whether firm also hedge interest rate or exchange rate exposure. Other variables are defined in Table 2. All independent variables are measured one year before the identified shocks. T-statistics are calculated using heteroskedasticity adjusted standard errors and clustered at the firm level. ***/**/* indicates 1% /5%/10% significance level respectively.

	(1)	(2)	(3)	(4)
	Market share growth difference	Market share growth difference	Relative ROA difference	Relative ROA difference
UH	0.188	0.233	0.059	0.045
	(1.17)	(1.52)	(0.72)	(0.59)
CH	0.161	0.187	0.100	0.091
	(1.13)	(1.30)	(1.05)	(0.98)
CU	-0.195	-0.213	-0.021	-0.035
	(-2.31)**	(-2.43)**	(-2.03)**	(-1.95)*
Log (size)	0.034	0.040	0.015	0.014
	(2.45)**	(2.75)***	(2.17)**	(2.05)**
Long term debt	-0.267	-0.264	0.210	0.213
	(-0.90)	(-0.86)	(1.15)	(1.16)
Investment	-1.453	-1.309	0.007	-0.075
	(-2.60)**	(-2.34)**	(0.02)	(-0.20)
ROA	-0.479	-0.525		
	(-0.84)	(-0.94)	-	-
Dividends	-3.955	-4.330	-1.467	-1.270
	(-0.79)	(-0.83)	(-0.45)	(-0.38)
Cash holding	0.073	0.062	-0.127	-0.132
	(0.15)	(0.13)	(-0.31)	(-0.33)
R&D	-2.730	-2.841	-0.957	-0.944
	(-0.84)	(-0.88)	(-2.50)**	(-2.43)**
Q	0.046	0.042	-0.061	-0.060
	(0.57)	(0.50)	(-0.80)	(-0.78)
Herfindahl	-0.337	-0.417	0.117	0.161
	(-2.06)	(-2.26)**	(1.08)	(1.39)
Option hedge	0.102		-0.067	
	(1.74)*		(-0.93)	
Option hedge*UH	0.309		0.061	
	(2.03)**		(1.87)*	
Hedge other exposure		-0.043		0.003
		(-0.31)		(0.07)
Hedge other exposure* UH		0.132		0.072
		(1.60)		(0.91)
Constant	-0.183	-0.195	-0.062	-0.057
	(-0.99)	(-1.09)	(-0.47)	(-0.44)
observations	452	452	452	452
Adjusted R2	0.09	0.08	0.132	0.128

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